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[The following are translations of selected articles in the Russian-language monthly journal AVIATSIYA I KOSMONAVTIKA published in Moscow. Refer to the table of contents for a listing of any articles not translated.]

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AVIATION AND COSMONAUTICS

No 2 February 1990

AF CIC Rationalizes Offensive Characteristics of Air Force

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pp 1-3

[Article by twice Hero of the Soviet Union Mar Avn A. Yefimov, commander in chief of the Air Force and deputy minister of defense USSR: "Defense of the Homeland and the Air Force"]

[Text] The people are celebrating the date honoring their glorious Armed Forces in the complex situation of perestroika processes taking place in this country. Our Armed Forces were born 72 years ago, when on 28 January 1918 the Council of People's Commissars issued a decree calling for organization of a Workers' and Peasants' Red Army [WPRA]. And in the latter half of February its young units, small in numbers but strong in revolutionary spirit, engaged in savage fighting at Pskov and Narva, brought to a halt and crushed elite units of Imperial Germany which were driving on Petrograd.

In a fighting partnership with the other combat arms, the Workers' and Peasants' Red Air Force also defended the achievements of the Great October Revolution against the first onslaught by world capitalism and domestic counterrevolution. Red military pilots performed various missions. They conducted visual and photographic reconnaissance, bombed and strafed enemy personnel, equipment, and installations, fought for air supremacy, fought off amphibious assaults, performed artillery spotting for field artillery and naval gunfire, provided liaison and communications services, and scattered agitation and propaganda leaflets.

Young Soviet military aviation took part in practically all WPRA operations—in the east, south, north, and west. In spite of limited manpower and inadequate equipment, it provided skilled assistance to ground and naval forces and made a worthy contribution toward the defeat of the interventionist and White Guard armies. During the years of civil war military aviators flew more than 21,000 sorties, dropped 94,500 kilograms of bombs and 9,000 kilograms of agitation literature, and fought 144 air-to-air engagements, in which they downed 21 enemy aircraft. For courage, valor and heroism displayed in defending the socialist homeland, 216 pilots and aerial observers were awarded the highest decoration of the time—the Order of the Red Banner; 19 persons were twice awarded this decoration, while P. Mezheraup, Ya. Moiseyev, S. Monastyrev, I. Pavlov, and Ye. Ukhin were three-time recipients.

Failure of the first armed invasion of the Soviet Republic did not mean that it would never happen again. V. I. Lenin warned the party and people that the danger of war would remain as long as imperialism continued to

exist. "...Be on guard," he urged. "Fiercely protect the defense capability of our country and our Red Army." The next military conflagration erupted on 2 October 1929 in the eastern part of the country. Chinese-Manchurian militarists attacked the Soviet-owned Chinese Eastern Railway. The troops of the Special Far Eastern Army, supported by the Transbaikal Air Group, joined battle with them. The Soviet pilots were forced to operate in adverse weather conditions. But they successfully accomplished their assigned missions: they conducted air reconnaissance in support of ground and riverine forces, bombed enemy fortified positions, and provided air support to assault forces as well as to the ships of the Amur Flotilla. The fighting continued to 29 November and ended in defeat of the aggressors.

In the mid-1930s the Germany-led fascist bloc commenced preparations for another world war. The arms race was also directed against the Soviet Union. International imperialist circles sought to establish a united anti-Soviet front and to settle their differences at the expense of the USSR.

The first to strike were Japanese invader forces, who mounted a provocative action on 29 July 1938 in the Lake Khasan area. The Soviet forces which fought them included 180 bombers and 70 fighters. The military aviators bombed and strafed enemy fortifications and reserves. The assault on Zaozernoye Hill on 7 August was preceded by an hour and a half of preliminary airstrikes. The enemy sustained substantial casualties and was demoralized. Airstrikes continued during the next two days. Air actions played an important part in the crushing defeat and expulsion of the aggressors from Soviet soil.

The events on the Karelian Isthmus (30 November 1939-13 March 1940) were the next major test for the Soviet Army and its Air Force. The USSR was unable through talks with Finland to resolve the issue of ensuring the security of our country's northern border and Leningrad, and an armed conflict arose. The forces of the Leningrad Military District (subsequently the Northwestern Front) were supported by an air combat force totaling about 1,600 aircraft.

Air forces were used for the most part in close coordination with ground force elements, that is, on a tactical scale. Experience was also gained in the massed employment of aircraft in the difficult weather conditions of a severe winter and at night. Air played an important role in breaking through the Mannerheim Line, which had been considered impregnable, and in obtaining a cease-fire. During the entire period of combat operations military aviators flew more than 84,000 sorties, dropped more than 23,000 tons of bombs, and downed 362 White Finn aircraft in air-to-air combat. The homeland had high reward for the heroism and courage of Air Force personnel: 92 combat airmen were awarded the title Hero of the Soviet Union.

The war revealed, however, a number of deficiencies in Soviet military aircraft. It became obvious, for example, that Soviet aircraft were not fast enough. This prompted accelerated production of new aircraft, and the ensuing upgrading of the Air Force transformed it from a combat arm to a full-fledged branch of service. A decisive factor was the creation of powerful combat (bomber, ground-attack, and fighter) air forces capable of conducting independent operations on various scale.

The Great Patriotic War constituted a particularly difficult test of the mettle of the world's first socialist country. Fierce, bloody combat engagements with the German-Fascist invaders erupted beginning early in the morning on 22 June 1941, encompassing an area stretching from the Barents Sea to the Black Sea. The Soviet Air Force acquitted itself with distinction in this deadly battle, which lasted almost four years. In spite of the treacherous attack by Hitlerite Germany, the Air Force succeeded in maintaining its combat capability, in conversion-training flight personnel and ground crews over to new types of aircraft under incredibly difficult conditions, in extensively utilizing obsolete aircraft to deliver strikes on the enemy, continuously to seek and skillfully to apply effective modes and methods of combat operations and tactics, and ultimately to inflict crushing defeat on the Luftwaffe.

During the years of ordeal the main efforts of our military aviation were focused on three missions: the battle for air supremacy, support of ground troops and naval forces, and the conduct of aerial reconnaissance. Our military aviators also were regularly striking important targets deep behind enemy lines, hitting the enemy's strategic reserves, and interdicting the flow of troops and supplies.

The Air Force took part in all defensive and offensive operations. Over the course of the war aircrews flew approximately 4 million sorties and dropped more than 30 million bombs representing an aggregate weight of approximately 700,000 tons, inflicting enormous casualties and combat equipment losses on the enemy. Soviet aviators accounted for 57,000 out of the 77,000 enemy aircraft destroyed on the Soviet-German front. As the most powerful and mobile branch of service, the Air Force exerted considerable influence on the outcome not only of individual operations but of the war as a whole.

The defeat of Fascist Germany, however, did not mean that World War II was over. In the Far East Germany's ally, Japan, was continuing combat operations against the United States, Great Britain, and China. Therefore, true to its pledges to the member countries of the anti-Hitler coalition, on 9 August 1945 the Soviet Union commenced combat operations against the Japanese militarists. The enemy had approximately 2,000 aircraft, while we possessed 4,076.

Soviet aviators were compelled to operate in a difficult environment, however. A theater of vast size, unstable

weather, and mountain-and-desert terrain made it difficult to carry out combat missions, which in addition involved unique features (delivering strikes on fortified areas, supplying fuel and ammunition to swiftly-advancing tank and motorized columns, providing air support to amphibious assault landings, etc). But the aircrews accomplished their missions with flying colors. They disrupted lines of supply and communication, prevented maneuver of reserves, and with precision strikes on enemy pillboxes and concentrations of troops and equipment, they helped friendly ground forces rapidly break through the zone of fortified areas. In the course of the Manchurian Operation military aviators flew more than 22,000 sorties and dropped approximately 3,000 bombs, making a large contribution toward the crushing defeat of the Kwantung Army.

During the war years pilots, navigators, aerial gunner-radio operators, engineers, technicians, and mechanics displayed exceptional courage, staunchness, selflessness, and combat skill. The 636 aerial rammings and 505 instances of flying a burning aircraft into an enemy target attest to their ardent love of the homeland and burning hatred toward the invaders. Two air aces—A. Pokryshkin and I. Kozhedub—were three times awarded the Gold Star Medal, 61 were twice awarded this decoration, and 2,271 military aviators were named Hero of the Soviet Union (corrected figures). The glorious ranks of winged heroes contain representatives of all military aviation branches and components. Illustrious deeds by fearless combat pilots, performed in the course of fighting for the freedom and independence of the socialist homeland, are represented by the sparkling facets of these Gold Stars.

Forty-five years have passed since the Great Patriotic War came to an end. And during all these years our valiant Armed Forces have served as a reliable guarantor of the peaceful labors of Soviet citizens. Armed Forces organizational development is being performed taking into account the need to guarantee the security of the USSR and its allies, as well as under the influence of sociopolitical changes in our country's life and affairs. In April 1985 our people commenced a revolutionary restructuring of society and the creation of a state governed by rule of law. International relations are also improving as a result of broadening zones of confidence. In present-day conditions, with world stockpiles of enormous quantities of conventional, nuclear, chemical, and bacteriological weapons, the task of survival is the main task for all mankind, with no other alternative.

Displaying the new political thinking on issues of war and peace in the nuclear age, problems of defense and guaranteeing equal security, the Soviet Union and the other Warsaw Pact countries are directing their efforts toward further lessening the threat of outbreak of war. Their adoption of a fundamentally new defensive military doctrine constitutes vivid confirmation of this. The allied socialist states have declared that they will never, under any circumstances, be the first to initiate military operations against another state or alliance of states

unless they are the target of aggression, and that they will never be the first to use nuclear weapons. The main feature of this doctrine is the fact that it is subordinated to the task of preventing war.

Organizational development of the Warsaw Pact Joint Forces is grounded on the principle of sufficiency for defense, which means the necessity to maintain military forces required for defense against external attack. Troop strength, weapons levels, and combat readiness are commensurate with the threat level, nature and intensity of military preparations by the potential adversary, with the objective of not being able to be taken by surprise. Reasonable sufficiency consists essentially in preventing an unanswered nuclear attack in any situation, even the most unfavorable situation for us. In all cases the level of strategic offensive arms should ensure a retaliatory strike whereby the aggressor will be unable to continue the war.

Recently we have heard many statements casting doubt on the existence of a genuine military threat on the part of the United States and the West. It is claimed that such a threat is made up by the military in order to justify their existence. But let us recall the eve of the Great Patriotic War, similar pacifist attitudes on the part of a segment of the public and the price which was paid for this. We must not forget the lessons of history. Since enormous arsenals of arms still exist in the world, it is premature to count on resolving all issues and problems through talks and negotiations. Extremes are dangerous as well, particularly when we are dealing with our country's future.

Of course substantial positive changes are taking place, but there is also another aspect. The aggressive directional thrust of U.S. and NATO military doctrine, which presumes the conduct of both a multivariation nuclear and conventional war, remains unchanged. They are not renouncing first use of nuclear weapons or development of their own military-technical programs aimed at gaining military superiority. To this we must add that the socialist countries are encircled by a network of 1,500 military bases and installations, at which more than half a million U.S. military personnel are stationed, as well as vast quantities of modern arms and equipment, including more than two thirds of U.S. tactical nuclear weapons. Nevertheless at the present time war is no longer an inevitability, but the possibility of war has not yet been totally eliminated.

The defensive thrust of military doctrine presumes substantial changes in the nature of actions by the Soviet Armed Forces and the allied armies. Defense is viewed as the principal type of military action in repelling aggression. Defense aims at halting the enemy's advance, at wearing the enemy down by attrition, and at achieving crushing defeat of invading enemy forces. But our troops and naval forces must subsequently be capable of turning to a determined offensive. Success of the defense will depend in large measure on how promptly and in how

organized a fashion the Air Defense Forces and Air Force meet the air adversary.

The role and place of the Air Force in a conventional war are determined primarily by the need to deliver retaliatory and attack-meeting strikes, to seize the initiative by gaining and holding air supremacy, and to provide close air support to ground forces. The particular significance of air forces in war is dictated by their versatility of application. Aircraft are highly mobile, carry a great deal of striking power, have a substantial operating radius, and are capable of hitting various targets with precision. The Air Force is the only branch of service which with its own resources can successfully search out and immediately destroy small and highly-mobile enemy targets throughout a theater of military operations. Liquidation of intermediate-range and shorter-range missiles has further enhanced the role of the Air Force as a long-range weapon in the hands of the command authorities.

Many people ask themselves the question whether the Air Force's offensive characteristics are in conformity with the defensive nature of military doctrine. How are aircraft going to defend themselves? After all, they cannot be put into trenches? This is a reasonable question. But in view of the fact that it has not previously been stated in this form, it might seem that we have an obvious contradiction here. But it only seems so at first glance.

First of all one must clearly realize that the missions of the Armed Forces as a whole are defined by defensive doctrine. These missions are to be accomplished by the combined efforts of all the armed services, branches, and combat arms. Each of these, however, as well as each item of weaponry possesses only those combat attributes which are characteristic of it. For aircraft these are strike characteristics. At the tactical level air actions can only be offensive, especially during the period of battle for air superiority. Past experience indicates that aggressiveness of defense depends in large measure on the capability skillfully to augment one's defensive actions with offensive actions. But this requires appropriate means of combat. The Air Force constitutes precisely such means of combat. Does this mean that the provisions of defensive doctrine do not affect the Air Force? No, they have very directly affected the Air Force.

First of all there has been a change in the relative emphasis placed on the Air Force's different components [fighters, bombers, etc], its structure and the composition of its force dispositions. Fighter forces advance to the forward echelon as the principal means of repelling hostile air attack. On the other hand, strike aviation is redeployed to bases further removed, which diminishes the possibility of sneak attack and increases the confidence of the parties. It is precisely for this reason that units equipped with Su-24 tactical bombers have been withdrawn from the GDR and have been replaced with MiG-29 fighter units.

There has also been a change in priority and precedence among combat missions handled by the Air Force. In connection with the fact that the enemy is initially given the initiative, reconnaissance by airborne and space-borne assets becomes the principal mission, and this is understandable, for effectiveness of turning back an attack depends to a significant degree on advance discovery of the adversary's intentions and preparations. Giving the adversary the initiative increases to an even greater degree the importance of a high degree of combat readiness on the part of combined units and units of all air components, especially fighters.

It is no secret that the adversary will attempt to deliver a first disabling strike precisely on our air forces, in order to avoid unacceptable retaliatory actions. History has recorded a great many examples of this type. The problem of enhancing the survivability of air forces as well as command and control facilities becomes particularly important under such conditions. Resolving this problem will require building means of protection at airfields as well as constant readiness to disperse and conceal aircraft during the period of threat preceding outbreak of war, plus preparedness to evade attack. For this reason training in actions to repulse a first strike and to crush the enemy's ground forces in the principal theater sectors, as well as improvement in the performance of headquarters staffs in the area of providing reliable command and control, plus a number of other elements, including maintaining a high level of flight safety, form the basis of organization of combat training of air combined units, units, and subunits in the new training year.

The effect of points of defensive military doctrine on the Air Force goes beyond what we have stated above. The Warsaw Pact member states, proceeding from the principle of reasonable sufficiency, have proposed mutual reduction of military potentials to a level at which neither side, while securing its defense, would possess the manpower and assets for offensive operations. And, to set an example, they have unilaterally adopted a decision calling for large-scale reduction of their military forces. The USSR is to implement this program by 1991. Reductions for the USSR are as follows: 500,000 men, more than 800 combat aircraft, and a number of air units and subunits.

This was followed by another initiative in June 1989, when the WTO nations presented a proposal at the Vienna talks to reduce troop strength in Europe of both military alliances by 1996-1997 to 1,350,000 men, to 1,500 strike aircraft, and to 1,700 combat helicopters.

The steps which are being undertaken, including unilaterally, do not signify diminished defense capability on the part of our country and do not remove from the agenda the task of defending the socialist homeland. It is proposed to compensate for the reduction of forces by enhancing the role of the human factor, by improving the organization and increasing the intensity of combat training of those who remain in the military. Defense

organizational development will henceforth be secured primarily by means of qualitative parameters. In the Air Force this long-range guideline extends to air tactics, aircraft and armament, as well as to training of personnel, from flight school cadets to the pilots in the line units.

In this connection a transition is being made to a multistage system of training: DOSAAF - Air Force school - specialized training center - air regiment.

With this approach a great deal of responsibility is borne by Air Force schools training flight personnel, which lay down the foundation for training future qualified specialist personnel. Certain changes have been made to date in handling this matter: effective methods have been devised for psychological screening and selection of secondary-school graduates, instruction in theory, and flight training. But their practical adoption is frequently hindered by an existing impeding mechanism, which is manifested in the form of old established traditions, excessive cautiousness, and sometimes disinclination by commanders at various levels to work with something new. This is having a negative effect on the processes which are taking place in the Air Force, and a resolute campaign is being waged against such things.

Perestroyka in the Armed Forces is continuing to pick up the pace in an atmosphere of nationwide preparations for the 28th CPSU Congress. The main task of the congress is as follows: by improving the work style of military cadres, further improvement in the effectiveness of combat and political training, democratization of all aspects of daily life, and all-out strengthening of discipline and strict observance of regulations, to raise each of these to a new and higher qualitative level. And even reduction is a kind of process of renewal in the spirit of the time. Even in these conditions, however, the USSR Armed Forces are prepared to carry out any order issued by the homeland and reliably to defend the productive labor of Soviet citizens and the achievements of peace and socialism.

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Suggestions For New Approach To Tactical Training

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pp 4-5*

[Article, published under the heading "Combat Training: Debates, Suggestions," by Col D. Goldyrev, candidate of military sciences: "Learning in the New Manner"]

[Text] Practical experience has repeatedly confirmed that in no area can one successfully solve an important problem if theory is divorced from practice. This also applies to air unit tactical training. Attesting to this, for example, are the results of a survey conducted in 1987-1989 by experts in the subject among frontal-aviation

command and flight personnel. The survey included 85 persons representing fighters, 31 representing fighter-bombers, and 56 representing bombers. 74, 30, and 28 persons (87, 98, and 50 percent) respectively replied in the negative to the question of whether they are satisfied with existing tactical training methods.

We shall endeavor to examine the causes of a poor level of tactical training. Toward this end we shall turn to history and trace the process of forming of conditions which led to the departure in combat training from the principle of "Teach the troops that which is essential in war."

The experience of the Great Patriotic War indicated that in order to achieve success flight personnel must possess not only excellent moral-psychological qualities but professional skill as well. Famed war ace A. Pokryshkin, for example, included the following triad in this synthesized concept: flawless flying technique; excellent proficiency in gunnery; versatile tactical proficiency. The importance of all components is obvious. In a combat environment, however, priority has always gone to the third member of the triad, and here is why. It was possible to create favorable (tactically advantageous) conditions for accomplishing the assigned missions only with diversified and original actions by aircrews, skilled distribution of efforts among air elements of different tasking function, and entering the target area with the element of surprise.

In the postwar period as well combat training in air units continued to be conducted fully in conformity with the above-mentioned principle. This was promoted to a considerable degree by the fact that many commanders and pilots were combat veterans of the Great Patriotic War and unswervingly followed the established traditions. Over a period of 10-15 years, in the course of which pilots were mastering the operation of first-generation jet aircraft, every training flight was jammed to the maximum with complex elements: for fighter pilots—expert-level advanced aerobatic maneuvers and the conduct of "free" air-to-air combat; for ground-attack pilots (later for fighter-bomber pilots) and bomber crews—operations at low and extremely low altitudes or with varying mission profile, air-to-ground attacks without setting up run on target, etc.

In the mid-1960s, however, as second-generation jet aircraft were entering operational service, there was an increase in the number of air accidents. A well-known CPSU Central Committee decree was issued in 1965, and flight safety became a matter of national importance. Sharply increased demands were placed on command and flight personnel. But this failed to result in an appreciable drop in the accident rate. Not only that, the number of mishaps through the fault of flight personnel increased from 16 percent in 1965-1967 to 28 percent in 1971-1973. And the high-stress psychological atmosphere engendered another approach: don't take a chance, keep things simple, avoid innovations, etc.

During this period there appeared in fighter aviation a very inappropriate idea of conducting air-to-air combat in the form of a "programmed" intercept mission, which formed the basis of combat training. An attempt was made to solve the problem of training combat pilots by applying this idea. Up to 50 intercepts were scheduled for each fighter pilot in some years. Practically the total of scheduled flying hours was expended on these intercepts and associated preparatory training sorties. As a result there was very limited opportunity to work on other elements which determine pilots' professional skill. Fighter-bombers also worked on intercepts, of course as a secondary mission.

As a rule these sorties were flown by single aircraft. Tactical control officers guided them from liftoff to return to the field. Of course the pilots' attention was focused for most of the time on the airborne radar display. They were essentially mastering only one component of the Pokryshkin triad: search, target "capture," and simulated missile launch. Could there be any element of tactics involved, if guidance vectoring time was considered the main criterion? I do not think so, for it would seem that this condition can be met only by following the shortest path, that is, a straight line. But in a combat environment straight-line flight to the target is unacceptable for aircraft of any Air Force component [fighters, bombers, etc]. This is a predictable pattern for which during war many airmen have paid with their lives.

Has the state of affairs appreciably changed today? As we see it, no. This is eloquently indicated by the survey results cited above. The majority of military aviators note excessive attention to form with harm to content, actions geared to show and pretense, stifling of initiative, fixed and standardized general patterns, bureaucratic paper shuffling, numerous restrictions when practicing complex maneuvers, plus other items as the main reasons for the unsatisfactory state of tactical training. Some express their opinion in more outspoken terms: tactical training is virtually nonexistent, with tactical training topics pulled out of thin air. The general opinion is that pilots themselves should be responsible for their own tactical training and proficiency!

One must agree with such assessments, but this is more precisely a consequence. The causes lie in the little effectiveness of the combat training system and lack of appropriate tactical training methodology. The commander in chief of the Air Force stated the task of radical restructuring of the latter and of bringing it into conformity with the requirements of the times. For all practical purposes this has not yet occurred. In addition, many commanders and senior officers continue to talk only about improvement but not about restructuring. Such a narrowly-focused attitude inevitably leads to uncertainty and tentativeness in one's actions.

Over the decades the problem has engendered persisting stereotypes, which will be more difficult to eradicate than it will be to handle routine tasks. Years may be

required for this. And each lost day at the start could result in a slowing of pace at subsequent stages by two to three orders of magnitude.

But in our opinion perestroyka should be conducted in three areas.

Elaboration of uniform scientific views and methodological approaches to organization and conduct of tactical training.

It makes sense to consider the following to be the principal components of this area: selection of tactics and tactical air training topics for the training year tailored to unit missions (we shall call this mission-specific training, when acquired knowledge is implemented in the course of tactical air exercises and field training exercises); creation of tactical training methods and using computers for developing tactical moves and for combat mission modeling and simulation; selection of scientifically validated criteria for evaluating the state of tactical proficiency on the part of commanders, flight personnel and staff officers, as well as the combat capability of subunits and units in relation to achieved results in mastering combat missions; promotion to higher positions and nomination for award (confirmation) of proficiency rating and honorary title with primary consideration of the tactical proficiency and the combat effectiveness of the subunits and units; improvement in the infrastructure of combat training, including tactics classrooms, air-to-ground and air-to-air ranges.

Restructuring of direction of combat (tactical) training at all levels.

The following can be considered the principal components of this area: radical change in methods of control and management, and particularly abandonment of a coercive-pressure style; offering sufficient autonomy to local commanders as regards organization and conduct of tactical training pertaining to specified items to be mastered during the training year; revision (refinement) of the functions of various echelons of authority and concentration of efforts on giving methods assistance to lower-echelon agencies, verification of quality and time-frame of mastery of assigned training items, and coordination of items connected with the conduct of joint tactical air exercises and air exercises with units (combined units) of other air components and branches of service; synthesis and dissemination of the advanced know-how of units at the air army and Air Force level.

Application of scientific methods to ensure flight safety and to improve the psychological climate in air units.

The following may be the principal components of this area: improvement of scientific-experimental methods of analyzing the causes of air mishaps in order to prevent such incidents; development of a precise method of air mishap prediction; improvement in the methodological level of commanders at all echelons; development in Air Force personnel of a high degree of personal responsibility for quality performance and flight safety for every

flight; addition of professional psychologists to flight safety service staff personnel.

The above-indicated areas produce a regulated, streamlined system of combat and tactical training in line units. Within the framework of this article we cannot present how they can be implemented. Work is currently in progress on some of the proposed components, and decisions have been made on some others. Therefore we shall discuss only the recommendations pertaining to the adoption of mission-specific study and mastery of tactics in frontal-aviation units.

Recommendations proceed from the position that teaching everything to commanders, pilots, and staff officers and expecting permanent retention is not a realistic task. In addition, due to a lack of time, study of tactics in the units is conducted in an unsystematic manner and separated from practical activities. As a rule handling training activities is assigned to officers who frequently are weak in the area of specialized training. One can count on excellent results only when immediate commanders handle training of their men. They should teach pilots on the ground and in the air, and primarily by personal example, just as in actual combat.

Another aspect consists in awakening interest in flight personnel in studying and mastering tactics in theoretical and applied form and in the course of tactical air exercises, creating motivation to be innovative in seeking solutions, as well as in initiative and independence. And the latter also engenders corresponding responsibility.

An aggregate of specific and interlinked problems of tactics, knowledge of which is essential in order successfully to master one's assigned missions, should become the focus of mission-specific study. In this connection it makes sense to determine one or two combat missions per training year for each frontal-aviation regiment, depending on the level of proficiency achieved by flight personnel. Then combined unit personnel will work on mastering several such missions at the same time, with the tactics and specific conditions of execution characteristic of each.

It will be necessary to draw up mission-specific ground and tactical air training programs for all missions. A maximum volume of materials will be obtained for the former. Subsequently it will decrease by approximately 25-30 percent by eliminating or reducing repetitive information on the potential adversary, points of already-mastered methods, and items pertaining to command, control, and support of combat operations.

The principal method of instruction is independent study under the supervision of immediate superiors. It is desirable to enlist academy instructors, higher-echelon officers, as well as representatives of other branches and services to lecture on the most complex and specialized topics.

A commander decision worked out in detail for mission execution in a combat situation, when all personnel or a majority of the regiment's forces will be (should be) involved, may constitute the result of applied study of a combat mission. Squadron commanders work out the tactics of subunit operations according to their role and place in the overall formation and particular missions. The flight (detachment) commanders, however, together with their pilots, work out tactical moves for each mission phase, taking the squadron commander's overall plan into account. In this situation clash of opinions in selecting an optimal verification is inevitable.

Specialist personnel from other services submit suggestions on supporting mission execution, while staff officers transfer operational plans to map form. Following successful defense of the operational plan before review commissions and approval of the operational plan by higher-echelon commanders, the tactical moves and other recommendations become a basis for practical implementation in the course of a tactical air exercise in the sequence specified in the mission-specific program (aircrew, two-ship element, flight-size element, etc).

Aircrues and subunits which are not prepared to master a specific overall mission may perform, on the instructions of the appropriate commanders, individual maneuver sequences as a two-ship element or flight-size element. All pilots, however, study in full tactics in theoretical-applied form. It is important to conduct tactical air training, especially squadron tactical air drills and exercises, in conditions of active moves by the adversary. Those elements which assume the role of "adversary" shall employ enemy tactics typical of the theater.

The above is a general methodological approach to mission-specific study and mastery of tactics in line units. It is fairly easy to determine the anticipated effect from its adoption. I would like to invite readers to debate this issue, for the ways to resolve this problem have certainly not been fully covered in this article. I believe, however, that the presented information is sufficient in order to give some thought to the question and to express one's ideas and opinions.

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Perestroyka and the Regimental Party Organization

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[Article, published under the heading "Anticipating the 28th CPSU Congress," by Col B. Kuznetsov, inspector, organizational party work section, Air Force Political Directorate: "When Deeds Mean More Than Words...."]

[Text] From the experience of a unit party committee working on adoption of political methods of influencing party members

The present stage of development of our society demands maximum exertion of effort by the party and each party organization. Practical activities and verification of execution of adopted decisions are taking on great importance. And nothing, M. S. Gorbachev emphasized in his address at the September Plenum of the Ukrainian Communist Party Central Committee, does such appreciable damage to the cause as taking a waiting position and weakness of organizational activity. He reminded his audience that the September (1989) CPSU Central Committee Plenum demanded that one not wait for instructions from the higher echelon but that one act immediately and decisively.

Unfortunately at the present time precisely such independence and decisiveness is lacking in many party member military aviators. And yet we know that waiting does not bring one closer to the objective, that the journey is completed only by those who take to the road.

I would like to discuss these issues. We shall be talking about the party organization of the Red Banner guards bomber regiment under the command of Guards Col V. Nikitin.

This outfit is one of Long-Range Aviation's finest. For a long time now these guardsmen have been consistently achieving excellent results in combat training. The regiment has not had any air accidents for more than 20 years now. In the last training year the unit's personnel were the initiators of socialist competition in the Air Force. The men met their fairly tough pledges with honor. The regiment earned the rating of excellent.

A substantial contribution is made by the unit and subunit party organizations toward the achievements of this collective. Recently there has been noted an appreciable increase in party influence on the on-duty and off-duty activeness of party members and all personnel. The men ascribe this positive trend in large measure to changes in the activities of the unit party committee and its secretary, Guards Maj V. Bandyukov.

Vyacheslav Ivanovich was commander of an air detachment prior to his election. An experienced pilot, indoctrinator and leader, a Communist of integrity and a campaigner for perestroyka, including restructuring of party affairs—all these moral, intellectual and professional qualities assured Bandyukov a majority of votes in the multiple-candidate election. Other Communists of like mind with the secretary in spirit and deeds were also elected to the party committee.

From the very first days in their new positions, Vyacheslav Ivanovich and the party committee under his guidance have been conducting a constant search for new approaches to party work. The activists are successful in one thing, less successful in another than they would like to be, but the main thing is that the party committee stands solidly on the road of perestroyka and

is ensuring a steady increase in party influence on people and the end results of the tasks they perform.

How is this achieved in practice? The reply to this question is in consonance with the demands of the 19th All-Union CPSU Conference: through comprehensive work with party members, by getting as many people as possible involved in party affairs.

Emphasis is unequivocally given to individual indoctrination. It is thoroughly planned and scheduled within the party committee and the party bureaus of the sub-units, and is focused on specific individuals, on development of their positive qualities and on correction of deficiencies.

For example, on the basis of a thorough analysis of the state of affairs in the regiment and its structural elements, the party committee identified a "risk group," that is, party members who had violated regulations or who had shown a tendency in that direction in flight training, in servicing and maintaining equipment, and in flight operations support, those who had not been readily obeying regulations. Party committee members work personally with these individuals, their commanders and superiors, offering practical and methodological assistance, demanding party accountability when necessary.

The party committee and party members pay constant attention to leaders in combat training, the top-performing specialists, and individuals who take active part in unit sociopolitical affairs. Their achievements and know-how are extensively publicized, synthesized, and disseminated. Last year, for example, the work experience of group chief Guards Capt O. Tabakov and crew senior technician Guards Sr Lt S. Dvorskiy was studied at the initiative of the party committee and recommended for adoption. Over the course of the year the party committee disseminated within party organizations materials synthesizing the experience and know-how of seven party members.

Nor are the so-called "middle performers" ignored. They are divided into two groups. One group contains those party members who for various reasons are considered "unpromising." And although they perform their duties conscientiously, they generally do not display initiative and avoid volunteer work. The other group contains party members who are satisfied with mediocre results. Specific measures and approaches, personalized in each individual case, are developed in the party organizations in working with the individuals in this group.

Party-member accountability reports have proven beneficial in the regiment's party organizations. Thorough preparations are made for these reports, the actual state of affairs regarding the topic under discussion is analyzed, and measures to correct deficiencies are thought out thoroughly.

A report presentation session as a rule deals with one problem or a group of problems, resolution of which depends to a certain degree on a given individual. But

sometimes it is necessary simply to "shape up" a party member or thoroughly to evaluate his performance. Last year more than half of all party members in the regiment submitted reports before various party bodies. Leader personnel were heard for the most part in the party committee or at party bureau meetings, while rank-and-file party members were heard in the shop-level organizations and in party groups.

The party committee has succeeded in changing people's attitude toward the party personal assessment of party members. At the present time approximately 80 percent of such assessments, in addition to positive qualities, also note shortcomings and contain recommendations and suggestions.

Individual interviews and presentation of accountability reports, as well as adherence to firm principles in writing up the personal assessment are making it possible to achieve better results in practical performance of tasks by party members, and are making it possible more effectively to instill in individuals the necessary moral and professional qualities.

A fairly high level of accountability by party members for committed misdeeds has been created in the party committee and party bureau, and an atmosphere of mandatory response to shortcomings has been created. In each instance thoroughness of analysis or investigation as well as an individualized approach are ensured. In this unit they have abandoned the practice of punishing party members according to the principle: since you have been called in before the party committee or bureau, a reprimand is inevitable. Not only punishment is used on the guilty parties, but more and more frequently educational measures as well. For example, in the first 10 months of last year party educational measures and measures in the form of comradely criticism, reprimand, and warnings were applied to 33 party members for minor offenses. For this reason the opinion has been formed in the unit that the party committee is not a "club" to be used against transgressors, but rather a collective adviser and assistant.

The party committee has succeeded in enhancing the role and significance of meetings. Agenda have become more relevant, and speakers have become better prepared. Activists endeavor to ensure that not one critical comment by party members is ignored. They are recorded and analyzed. All suggestions are studied, and appropriate measures are drawn up on the basis of such suggestions. Party members are regularly informed on progress in their implementation.

Just at one meeting, for example, at which the problem of improving flight safety was discussed, party members made approximately 20 critical comments and suggestions. Four of these were reflected in a resolution, and five were clarified in the course of the meeting. The remainder were promptly analyzed in the party committee. It was necessary to perform a special commission

to work on one of them. Implementation of three suggestions was assigned to party committee members, two critical comments were forwarded to the air base party organization, and four were forwarded to higher echelons. Specific measures were adopted on all critical comments and suggestions within two months, with party members promptly informed of these decisions.

The party committee promptly responds not only to criticism and suggestions presented by party members at meetings but also listens to people's opinions on matters prompted by the activities of daily life. Air Force personnel frequently come in for advice, assistance, and sometimes merely to share their thoughts and concerns. The secretary and his assistants endeavor to solve by party methods the various problems raised by party members.

Aviation engineering service personnel, for example, requested help in performing 400-hour routine inspection, servicing and maintenance on aircraft in the technical maintenance units of other Long-Range Aviation units. The party committee drafted an appeal to the party members of these regiments. The task was successfully accomplished through joint efforts. Or take another instance, where the party committee began receiving complaints about the unit's finance service chief. Maj V. Bandyukov visited the finance service and passed on to his colleagues the complaints which had been lodged against the finance people. An investigation was conducted in connection with revealed violations, and the guilty parties were punished.

The party committee constantly relies on the opinions of its activists, particularly advice offered by the secretaries, for coordination of party work in the regiment and determination of uniform approaches to solving various problems. Each month the party committee summarizes accomplished results and specifies ways to accomplish further restructuring. When necessary, regimental officials are called in to offer advice. The regimental commander and his deputy commander for political affairs, for example, were present during discussion of the role and place of party organizations in further increasing concern for others.

The regimental party committee endeavors to make amassed positive experience and know-how available to all party organizations. The experience of the 1st Squadron's party bureau pertaining to exerting effective influence on flight safety and the experience of the party organization of the 3rd Air Detachment of the 2nd Squadron in mobilizing party members to achieve successful accomplishment of adopted socialist pledges were synthesized and presented in a graphic manner.

Work is also being done in a purposeful manner to enhance the role of public organizations in the life of the unit and to ensure active participation by party members, including supervisor personnel, in the activities of public organizations. It is not mere happenstance that this regiment happens to have one of the best women's

councils in the Air Force, as well as well-organized amateur talent activities. Officers' and warrant officers' courts of honor are performing effective preventive efforts.

A healthy moral-ethical atmosphere is maintained in the regiment through the joint efforts of the command element, party committee, and councils of public organizations, and an attitude and mood are created for personnel to achieve high-quality accomplishment of tasks assigned for the new training year and adopted socialist pledges. It is important to ensure, not only in words but in deeds as well, a vanguard role by the majority of party members in performance of duty, military training, and discipline.

I should note, however, that the process of mastering political methods of influence in the unit party committee and party organizations is not proceeding as smoothly as might seem from my presentation. In the opinion of some of the party members with whom I have spoken, they continue to experience considerable difficulties in developing effective methods of influencing the quality and results both of flight training as a whole and in individual areas.

Not all party activists have a clear concept or picture of the prospects for further renewal of party affairs. The range of work forms and methods being used is limited in actual practice. The indoctrinal potential of party assignments is being poorly utilized. Party organizations have not yet fully become centers of ideological and political indoctrination of party members. The majority of deputy secretaries for ideological work continue to play secondary roles.

I feel that the party committee is being justly criticized for insufficient demandingness on leader-Communists in whose activities a social directional thrust has not been given primary emphasis and who either are unable or unwilling to engage in an open, lively discussion with Air Force personnel on all problems of perestroika which are of concern to them.

The party committee in turn does not always succeed in obtaining specific help from higher-echelon political agencies in resolving various issues. It often fails to receive materials synthesizing experience in perestroika amassed in the Air Force. As we know, it is always more difficult to learn from one's own mistakes.

Nevertheless the process of mastering political methods is exerting increasing influence both on the work style of the party committee and the party bureaus and on the overall state of affairs in the collective. It is true that success is not being achieved in all things right at the moment, but the main thing is that the regiment's Communists want changes in party affairs and are seeking to effect changes by means of their intellect and their labors, without waiting for instructions "from higher up." As I have already stated, there is a great deal

of positive experience meriting careful study and extensive dissemination in the activities of the party committee in which Maj V. Bandyukov serves as secretary. Nevertheless the most valuable thing about it in my opinion is the fact that party members are rejecting attitudes of total dependence on others and are seeking themselves to determine the content and ways of renewal of party affairs within the unit. This approach is in conformity both with the spirit of the times and the party's program guidelines for the period of preparation for the 28th CPSU Congress.

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Flight Safety Service Unappreciated

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[Article, published under the heading "Flight Safety: Experience, Analysis, Problems," by Lt Col A. Zhilin: "Treated Like a Poor Relation"]

[Text] The USSR Ministry of Defense Air Force Flight Safety Service is presently being treated like a poor relation. In addition, its unenviable position is being seriously worsened by a reduction of personnel.

* * *

Flight Safety Service (FSS) inspector Col N. Sharoyko ended a brief conversation with the command element of the fighter-bomber regiment to which he had come to log some flight time, to improve his skills, and to hold some flight safety classes. He had every reason to be pleased: the unit's flight personnel were all on base, so that the classes promised to be interesting and fruitful. Nor did there appear to be anything hindering him from logging his needed flight time. The weather forecast for the week was optimistic, and the neighboring range was in full operation, providing for all types of combat flying and weapons delivery for which Nikolay Ivanovich was coming close to the maximum for remaining current.

However.... No sooner had Sharoyko begun perusing the regiment's operations schedule for the coming week, when he was called to the phone. It was long distance. The Moscow Flight Safety Service duty officer informed him: "Nikolay Ivanovich, a plane will be picking you up in an hour. You have orders to proceed to the airfield at X. An aircraft flying maneuvers in the practice area has disappeared from the radar screens. You are to cut your flight safety instruction short and proceed there to conduct an investigation...."

"Another 'tactical problem'.... Can you beat that! When are we finally going to be able to do the work we are supposed to be doing, looking toward the future? All we are doing is playing catch-up! Instead of preventing air mishaps, we are barely managing to investigate them. And how are we investigating them? Unfamiliar types of

aircraft, from unfamiliar air components, and the accident investigation board is short on certain specialists.... Everything is backwards," the colonel said to himself angrily, heading for the officers' quarters to pick up his few belongings. Upset and essentially not knowing at whom, who had so "wisely" reorganized the Flight Safety Service, he was angry.

Following a long flight, Nikolay Ivanovich literally plunged directly from the boarding steps into the troubling business being addressed by the air accident investigation board, which had just begun its difficult job. The members of the investigation board—specialist personnel and experts representing various services, directorates, and industrial ministries—proceeded to gather and classify information on the aircraft which had failed to return to the field.

One of the local airbase officials came up to Colonel Sharoyko. He was noticeably nervous, but at the same time he looked fairly confident, as a person who is entirely sure of his blamelessness.

"In my opinion we should look for bird remains. It could not have been anything else. We know our pilots and technicians very well. They could not have made a serious error." Pausing a moment, he proceeded, even more emphatically: "It couldn't have been anything else! That is the way the report should be written up."

Unfortunately, what we had here was a repeat of what Flight Safety Service inspectors have seen and heard a hundred times in similar cases. They had not yet located the crash site, they had not yet determined the pilot's fate, and they had not yet found and recovered the flight data recorder tapes, not to mention the fact that all possible variations of occurrence and development of the situation had not yet been worked up, and yet officials were already hastening to draw conclusions. They are totally in the dark and confused, and yet they aggressively (to the extent of their ability based on position and other factors) push forth at all levels the view that the culprit is a "bird" or something of the sort. Can their position really be more important to them than the truth, the fate of a colleague and that of other pilots who, if the circumstances of the incident are not determined, may also find themselves in a similar predicament? It seems that their position is in fact more important, since they so aggressively and shamelessly attempt to dream up a "story."

Unfortunately many of them do not accept our moral values! But a Flight Safety Service inspector has no time for philosophy. Time is of the essence. There are a great many problems to solve, a great deal of work to be done, and plenty of misinformation to sift through. So get to work, investigator, work day and night, but keep a sharp eye out, so that you are not fooled by those who with their own "objective" data seek to conceal the nakedness of subjective inertia and miscalculations....

The fact is that an air accident is an enormous tragedy for the subunit, the unit, the family and loved ones of the pilot involved in a nonfatal mishap or fatal accident, and for his immediate superiors and colleagues who readied and sent off their comrade. But the realities of life are such that many individuals in this group, shattered by the incident and even sincerely wanting to get to the truth, psychologically concentrate their attention primarily on the immediate consequences of the mishap. The fact is that nobody is guaranteed against mistakes. One can most effectively analyze the entire aggregate of cause-and-effect linkages among the factors which led to an air accident (not to mention preventing similar incidents in the future) only with an objective, expert investigation by a board consisting of various specialists and headed by an outside chairman who is independent of the circumstances of the case.

It has long since been proven that fatal and nonfatal air accidents are the consequence of a very complex interweave of several adverse causal factors. Each of these factors frequently is apparent for an extended period of time, such as in deficiencies in method of performing a specific flight assignment, in ergonomic deficiencies of control panel or controls at a crewmember's station, in errors in the manual of flight operations for the given airfield or range, in an airman's latent medical problem, etc. As a rule a mishap occurs when these causal factors converge. Precisely for this reason the surest way to prevent air mishaps is conscientious elimination of all sources of occurrence of mishap-potential situations by each service (specialization area), the officers of which take part in organization of, preparation for, execution and support of flight operations. And if an air mishap has already happened, in order to avoid repetition it is essential to determine the shortcomings or deficiencies for which each service is responsible, not only the mistakes of the pilot, who in this instance is inevitably both victim and defendant, clarifying and transforming these deficiencies into preventive measures (in specific areas).

Unfortunately the picture is quite different at the present time. We should state in all frankness that precisely this multiple-factor nature of flight safety components and components of the causes of failure of flight safety—air mishaps—enables many officials and even entire services—not that they make a conscious effort but may just fail to devote the necessary attention to ensuring flight safety (concentrating solely on their own narrow professional interests)—to economize on prevention in a shortsighted manner and, if an accident occurs, safely to hide behind the immediate but far from the main causes of and persons culpable for the mishap.

In my view this harsh reality of the present day once more stresses the advisability of the full-fledged existence and functioning of a Flight Safety Service, the idea of which is so troubling and inconvenient (from the standpoint of security of position) to many commanders.

Nevertheless its already meager organizational, logistical, and even social status is becoming worse. Recently there have been increasingly persistent calls to do away with this service.

Its opponents are usually either commanders who are just beginning their command career or officials from the directorates of the large strategic formations and central administrative organization, whose deficiencies can no longer be concealed behind the old cliche "pilot error," and they motivate their demand with the claim that all leader personnel within the entire structure of the Air Force deal with flight safety. But why is it then that the massive existence of champions of flight safety is failing to produce effective results? Because each one proceeds primarily from his own narrow interests. For this reason there can basically be no unanimity of thought and action here. What is needed is an organizing center, the functions of which can be handled only by an independent Flight Safety Service. This is confirmed by the experience of the air forces of other countries.

Thus it makes more sense to think not about doing away with the Flight Safety Service but rather to consider why it is constrained in its work and how to improve its activities.

Flight Safety Service personnel, regardless of their intellectual abilities, are physically unable to improve the effectiveness of their work. Judging by all indications, extensive-type methods have exhausted their potential. Judge for yourselves: is a specialist capable of working productively on adoption of a flight safety plan if he is spending up to 200 days a year on the road? If he is given a maximum of seven to eight days to investigate the most complicated accident? If the data bank at his disposal is not a computer display but hundreds of thick file folders containing totally unsorted and unsorted information? If in a technical respect he is equipped only with a pencil and ruler? Of course not. As long as the Flight Safety Service is treated like a poor relation, we shall continue to see high accident figures.

Here is another reason why this service must be further developed, in the opinion of competent individuals with whom I have talked. The priority significance which is currently being attached everywhere to the demand for competence on the part of people in all areas also applies in full measure to the problems of flight safety. Can one, for example, compare the knowledge and experience in organization and conduct of air accident prevention on the part of regimental-level officers, who in their entire career have as a rule encountered (directly, not in documentary form) one or two air accidents, with that of Flight Safety Service officers who have taken part in investigating dozens of fatal accidents and nonfatal mishaps?

In addition, air commanders and flight and support service specialist personnel frequently deal with flight safety matters according to the residual principle. Such, unfortunately, is the current combat training system.

Having specific assigned duties, work schedules, and subordination to higher echelons within their specific area, frequently not coordinating their activities with the needs of preventing air mishaps, they are unable to organize their activities differently. Is it so surprising after this that commanders, in explaining to accident investigation boards why it is that after several flight operations shifts they failed to conduct a fully-meaningful training drill, failed to analyze the mistakes and mishap-threatening incidents which had occurred, and proceeded with another flight operations shift which had not been properly prepared for, and which ended with a mishap, placidly assert: "The flying time schedule has to be met; we had to fly."

And only a detailed analysis of the fatal accident or nonfatal mishap shows that the incident could have been entirely avoided with simple, specific actions by a great many individuals—from the pilot himself to those who put together the flight operations schedule and the air traffic control team. But supervisors do not immediately grasp the interrelationships of (prudent) flight safety (they wanted to gain a flight operations shift, but they received instead grounded operations for the entire time of the accident investigation). And of course it is better if this is grasped through interaction with experience amassed on this problem at an earlier time rather than by means of personal trial and error. And a well-organized Flight Safety Service can help achieve this.

The work experience of the most highly-trained Flight Safety Service officers persuasively indicates that one can achieve the greatest effect in preventing air mishaps not by recording violations of regulations and communicating these facts to the higher-echelon command authorities in order to bring a flood of punishment down on the heads of the guilty parties. Emphasis should be placed on painstaking constructive efforts to prevent air mishaps in air regiments. Judging by all indications, what is necessary first and foremost is a massed attack on those chronic shortcomings which in some measure have become even an accustomed background to our meager existence and the cause of more than one serious air mishap.

The most experienced Flight Safety Service officers: Cols N. Sharoyko, Yu. Timchenko, and other of their colleagues—seek to build their work precisely in this manner. However this same air mishap prevention work has been suffering more and more from the strange handling of Flight Safety Service personnel matters. There has virtually been a complete halt at the combined unit and large strategic formation level to the assignment of promising, energetic officers who are young enough and have prospects for further career advancement. One must acknowledge as regrettable and absurd from the standpoint of normal logic the fact that the Flight Safety Service is now being viewed at all echelons as a dead end, as a place to serve out one's time for Air Force personnel who were unable to handle their previous position or who were guilty of personal oversights in flight operations or discipline. And yet it would seem that it is clear

to all higher-ups that intelligent staffing of the Flight Safety Service with well-trained, promising officers at the "squadron commander-regimental deputy commander" echelon will make it possible not only to invigorate the service but also to train reserve leadership personnel for the Air Force who have obtained thorough practical experience in organizing air accident prevention at various levels. That is, in addition to all else, the Flight Safety Service should also be a school of wisdom for command cadres.

One of the major difficulties in the functioning of the Flight Safety Service arises due to the fact that it was unwise included among the central administrative subdivisions to which personnel reductions were to be applied. This is unquestionably a vital process in relation to the current situation. But in the final analysis one should not blindly correlate the current number (not to mention the scheduled reduction figure) of officers with the growing volume and complexity of work activities, particularly in the line units. There are those who stubbornly pretend that they fail to grasp the fact that Flight Safety Service pilots, navigators, and engineers are not desk-jockey bureaucrats and headquarters types, that they are the laborers of a difficult and highly humanitarian profession, who spend periods of six months of more away from home.

Many military aviators are presently coming to the conclusion that concentration of the totality of demandingness exclusively on the pilot who was performing a flight assignment during which a mishap occurred does not lead to the desired decrease in accident rate. The assault should be mounted along a broad front, through the combined efforts of all aviation services, which are called upon maximally to concern themselves with flight personnel labor safety, for the end result of their activities is not simply observance of regulations but first and foremost flight effectiveness and safety, which are frequently achieved by the pilot (crew) in far from standard conditions. And unquestionably it is first and foremost the Flight Safety Service which is capable of providing the best assistance to the command authorities in co-ordinating the efforts of all specialist personnel.

Frequently FSS opponents focus attention on the allegedly inadequate performance effectiveness of FSS staff specialist personnel, particularly as regards the central service, pointing to instances of air mishaps in units which had just been visited by an FSS pilot or engineer-inspector. And yet an FSS officer should answer for a specific air mishap only if he personally was directly involved in organizing, preparing for, and directing a flight. The work effectiveness of this service, however, should be graded for a specific period of time on the basis of change in the overall trend in accident rate in a combined unit, large strategic formation, and Air Force component [fighters, bombers, etc]; by the rate of recurrence and gravity of air mishaps, objectivity of accident investigation and effectiveness of undertaken preventive measures.

Experience indicates that it would make sense for the Flight Safety Service to shift efforts more to the preventive aspect of its activities, to formulating the most acceptable practical, not just generally possible methods of preventing air accidents—applied not only to specific Air Force components but even to aircraft types. I feel that this painstaking, extensive job could be accomplished most fully in coordination with the combat training centers of the Air Force component branches. Thus it would be focused, in the first place, primarily on the direct needs of the line-unit pilots and, secondly, would help eliminate differences in approach to accomplishing basic tasks both of combat training and flight safety, which unfortunately are still far from optimal resolution and frequently add to the daily burden of many Air Force units.

Coordination of the efforts of all Air Force personnel on comprehensive achievement of the requisite levels of combat proficiency, while observing the requirements of flight safety, is the most critical task for the Air Force at the present time. A strong Flight Safety Service capable of functioning efficiently can prove its full worth in this endeavor.

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Aerobatic Pilots at Kubinka Described

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[Article, published under the heading "Encounters at Airfields," by Galina Marchenko: "Military Pilots"; part one of two-part article]

[Text] "Our ancestors the Gauls feared nothing. They feared only one thing: that the sky might fall on their heads." A French saying

The sky over Moscow was particularly blue and majestic on that bright spring day, and it was crisscrossed by white vapor trails left by jet aircraft. Directly overhead two white arrows were proceeding along against a blue background. Holding a precisely parallel track, one slightly ahead of the other. Only military pilots fly like that—leader and wingman....

Military pilots.... In art and literature we have been accustomed in the past to "reflect" people by occupation. Apparently in many respects this has been preserved up to the present day. And military pilots do not at present represent that profession which is generally "reflected." Although these people are perhaps the bravest and most romantic of our fellow countrymen. It is that profession which takes such human qualities as self-control and willpower, speed of thought and reaction, faith in oneself, and ability to achieve an objective beyond the framework of mundane existence, beyond

the limits of the possible. And to this add honesty and reliability in one's relationships, without which there are no genuine pilots.

In other countries, such as the United States, Great Britain, Canada, West Germany, Italy, and France, that is, in countries with a high level of development not only of military technology but of culture as well, pilots enjoy particular attention and respect as people of a courageous and unusual profession. In those countries they write not only about their own pilots but about ours as well....

It began with a visit by U.S. Secretary of Defense Frank Carlucci to a military airfield located not far from Moscow, near Kubinka station. Newspaper correspondents and TV reporters from many countries were permitted to go along. In the process of acquainting the American visitor with our aircraft, the pilots of a precision aerobatics squadron demonstrated their skill on modern military aircraft. Carlucci marveled at their fantastic ability. During his interviews he highly praised these pilots, and he praised in general the proficiency of the men of our Air Force.

This served to heighten interest on the part of foreign journalists. Taking advantage of the permission they had been granted, they took pictures and TV footage of Soviet military pilots and interviewed them. Foreign guests and members of the foreign press corps are continuing to visit Kubinka.

One encounters in the Soviet press, however, very little information about these pilots, and many readers not only do not know their names but have no inkling of the existence of such heroic fellow countrymen.

Modern military aircraft! They seem to be from another planet. Just simply sitting in the cockpit takes one's breath away. And the impressions from actually flying? The aircraft rushes headlong down the runway, lifts off and streaks skyward, within minutes climbing to an altitude of 20 or 30 thousand meters. And up there the sky is no longer blue but an unaccustomed dark-violet hue. And there is no other object in sight—you are alone in a boundless sky....

A squadron of aerobatic pilots, an element of the Regiment imeni Lenin Komsomol, is based at Kubinka. Obviously many of these pilots are acquainted with expert-level advanced aerobatic maneuvers: loops, loops in less than a vertical plane, snap roll, wingover, and others. Small, propeller-driven aerobatic lightplanes are designed for such maneuvers. They are slow, and in an emergency they can glide to an engine-out landing. But we are dealing here with jet engines and corresponding speeds.

And the military pilot skilled in advanced aerobatic maneuvers must get his bearings instantly in this unimaginable swirling domain of earth, sky, and horizon, control his aircraft with jeweler's precision, and in so doing withstand enormous G forces.

But this is only a theoretical assumption of what the pilots experience up there. We see in the sky only airplanes streaking above the earth at high speeds, soaring into clouds as they execute complicated maneuvers. One cannot compare them with giant birds—birds do not fly like that. Would a bird get it into his head to fly inverted or rolling on his own axis? Only man flies like that, in his eternal striving to make things ever more complex, to push things to the limits of the possible....

On USSR Air Force Day an air show is held at the Kubinka airfield, including an aerobatics demonstration. This is worth watching! For such a spectacle engenders in people's hearts a fantastic feeling—fear and rejoicing simultaneously. The fact is that a person who has succeeded in overcoming his limitations and in going beyond his prescribed limits acquires something amazing for his soul, for his inner world. Evidently this is why the cult of sports has existed throughout the entire history of mankind.

But the sport practiced by military pilots also has a practical significance: it is the art of air-to-air combat. It is not surprising that foreign correspondents have taken an interest in Soviet aerobatic pilots. Three years ago during demonstration flights at Kuopio, Finland, Soviet Major Vladimir Shilin was named the world's best pilot. Today Lieutenant Colonel Shilin, flying a MiG-29, is continuing to accomplish the improbable. It is as if he imparts his own spirit to the aircraft, to this streaking mass of metal, which displays a fantastic freedom and plasticity in motion.

Maj Valeriy Kravtsov flies the "Cheburashka" ["Little Critter"]—this is the nickname pilots have given the Su-25 [Frogfoot] ground-attack aircraft. His solo flights are both graceful and dramatic. Kravtsov emphasizes the extreme limit at which he works. He even shoots his landing approach in a special way, approaching the runway practically at a right angle. Lt Col Vladimir Bazhenov flies the MiG-29, and his banked turns show so much confident strength that the bending of this flying energy to man's will is clearly evident. Maj Sergey Kirillov flies the Su-17 and the Su-25. His flights are enchantingly poetical. Lt Col Anatoliy Arrestov leads four Su-27s in a diamond formation, and Col Vladimir Basov leads a "nine."

Basov was placed in command of the aerobatics squadron several years ago; prior to that time he had not flown expert-level advanced aerobatic maneuvers. Once he made an adverse comment to one of the pilots, who replied: "Well, Comrade Lieutenant Colonel, why don't you go up yourself and show us how to do it?"

He took this to heart and proceeded to work on aerobatic maneuvers. He was successful. On one occasion he in fact did go up and demonstrate....

At the beginning of our acquaintance, in the control tower building, all of them, wearing anti-G suits and

carrying flight helmets, seemed to me as unreal characters, like in the movies. I subsequently got to know them better and could see the variations in their human characteristics.

Vladimir Shilin, blond and blue-eyed, gives the impression of a modest man of few words, a person who keeps his distance. He would rather commune with nature, go fishing, or take a vacation trip than socialize with others. That is the way with people who have learned something more about life, which you cannot explain to others. Nevertheless I asked him what he felt up there in the sky.

"Up there my soul sings," he replied, and smiled in a slightly sheepish manner, realizing that it is difficult to describe his state.

Vladimir Bazhenov is a determined, energetic, strong individual, and behind this I can see kindness and the ability to understand others. Sergey Kirillov is highly attuned to his inner world, which seems to have its own melody. He could be taken for a poet. Anatoliy Arrestov is a good-looking, charming, dashing young lad. Maj Sasha Shishkin is very interested in people, in life, in its most mysterious phenomena, and he is always polite and solicitous.

All of them, however, and their comrades as well, have something in common. It is an obvious reserve of human toughness, spiritual strength, and accepted responsibility. They are also real men, precisely that other half of mankind.

Back when we first became acquainted Capt Igor Sakhnenko, also an aerobatic pilot, gave me a piece of advice: "Keep after Kravtsov. He has an unusual thought process. He can discuss highly complex things in a simple and understandable manner, and he can point out something new in a phenomenon familiar to everybody."

It is indeed always interesting to talk with Valeriy Kravtsov, and it is particularly the charm of intellect. Talking with him is like playing chess with a gifted partner. Sometimes he speaks in a purely aphoristic manner. I once made a comment about some common acquaintances: "A lovely pair, and both so nice...."

"What we have here is the unity of a king on a playing card," replied Valeriy. "They are gazing in different directions."

His stories are so fascinating: "I took off in a dual trainer with Aleksandr Fedotovich, you know him, and the instruments immediately started failing, all instruments on the right side, and soon we lost communication with the tower. The weather was not so good. Low overcast and rain. We swung around to return to the field. Instruments were not working, we had no communications, and something else could go out at any moment. I had the controls.... 'How much fuel do we have?' asked Aleksandr Fedotovich. 'Two buckets of kerosene,' I replied, 'will be left after our 16th approach attempt,' and I am wondering to myself how we are going to be

able to find the runway. The cloud bases had dropped lower. But we made it on our first approach. 'It's a good thing you remembered the brush by the runway,' said Aleksandr Fedotovich. 'Did you get your bearings off the brush?' 'Yes,' I replied, and then suddenly said to myself: 'What brush?' I didn't see anything. I was groping my way down...."

This was not the first difficult situation which Valeriy related to me. Every pilot has plenty of them.

"As you can see, I've been lucky so far," he once remarked.

"Not just lucky. You have a high degree of professionalism. Intuition."

"I don't know," replied Valeriy. "Everything can go bad at once. It is better if things go bad one at a time."

Valeriy talks about aircraft as if they are living beings, relating their character and personality. One winter day two young pilots banged up a dual trainer on takeoff; they confused the switches and retracted the landing gear. The aircraft, sending showers of sparks across the concrete, sank onto its belly. The pilots were not hurt.

Valeriy drove out to check it out. He was upset when he returned. "The technicians and mechanics are working on the plane. It is lying there on the concrete, and I had this feeling that the plane was not feeling well, that it was in pain!"

Valeriy has a sweet, attractive wife, Natasha, and a six-year-old son, Zhenya. Natasha is a doctor, specializing in therapy. She works at a sanatorium not far from the base. I once saw little Zhenka with his father, who had just returned from flight operations. They were engaged in animated conversation, and they looked to me like a live illustration to Saint-Exupery's "Little Prince." Particularly since I already knew what a sober-minded little fellow Zhenya is and what childlike enthusiastic pride he has in his father.

On one occasion recently we had scarcely entered his door when his son's triumphant voice rang out: "Daddy's home!" And one second later Valeriy was picking his son up in his arms. I believe only sons of military men greet their fathers like this. Valeriy finds time to spend with his son; both are fond of model airplanes. After Zhenka had left us, Valeriy said: "In the past I was sometimes frightened by the thought of death. If something were to happen to my airplane—and the fear of death! This is a very powerful feeling. I was afraid that I would suddenly yield to it, would lose control over myself, and would proceed to save my own life, when perhaps this was not the right thing to do. I now know who will stop this fear in me. Zhenka! All I have to do is think about him, and that is it! I shall never do anything which would allow somebody to say to him later: 'Your father acted like a coward.'"

Valeriy's tactfulness is pleasant, as is the inherently artistic nature in his bearing. It seems to me that in

persons like him is reborn a certain spirit of the Russian Army, the image of the Russian officer intellectual, characteristic of the Russian Army in the old days.

I shared this thought with Valeriy.

"In the past the term 'officer corps' was always used, while today the term 'ofitserstvo' is used. A rather unattractive word, like 'meshchanstvo' [petty bourgeoisie]. How can you talk about officer's honor today, when some superior officers allow themselves to speak to us in a manner where a Russian officer would shoot himself after the fourth word, the present-day Briton—after the fifth word, while I, a Soviet officer, hear him out to the end, and then say: 'Yessir!' and take the abuse...."

Valeriy called me one raw, gray winter day. I complained to him about the murky sky pressing on the rooftops.

"That is not the sky. That is only cloud cover," Valeriy retorted. "It may be thick, but it doesn't extend very high. The sky above you is blue and the sun is bright. I just came down. No matter what the weather, don't forget that blue sky and bright sun area always above you...."

The history of the air regiment imeni Lenin Komsomol dates from the legendary figures of those pilots who fought in Spain. Of course the regiment does not only work with aerobatics. It follows a difficult military life routine, just as any regiment: flights into the practice area, practicing strikes on ground targets, practicing air-to-air engagements, and tactical exercises.... War and peace are presently proceeding along parallel courses.

But imagine what things would be like in this country if there were no military pilots? We were caught unawares once before, and this horror is enough to last generations. One of my relatives has a little boy, Alesha, 5 years old, who likes to draw and frequently draws war pictures.

"Do you see these airplanes?" he points to his drawing. "There are lots of them! On each one there is a swastika and bombs, and there are swastikas on the bombs.... These are our houses. They want to drop bombs on our houses.... Don't be afraid! Here come our fighters. And they will not let them...."

"It must be in his genes," his grandmother said to me. "His grandfather was a military pilot, and his great-grandfather had bombs like this dropped on him when he first went into combat."

"The Russian pilots are intrepid, but their airplanes are made of paper," the fascists used to joke during the war.

And in truth, God knows what kind of airplanes our pilots were initially flying into combat. But they certainly knew how to fight! There were a great many aerial rammings right on the first days of the war! Vladimir Vysotskiy expressed in his songs both gratitude and the people's love for their combat pilots at the front, as did movie director Leonid Bykov in his film "Only 'Old Men' Go Into Battle."

...Maj Valeriy Korneyev was killed at Kubinka in February during mock air-to-air combat. Air combat is after all combat, even a training sortie. Valeriy left three sons, the youngest of whom is 18 months old. In the spring Capt Aleksandr Georgiyev was killed before the very eyes of his comrades while flying an aerobatic maneuver. He left two daughters, the older of whom is five years of age....

Military pilots are heroes in peacetime as well. They endeavor fully to master their profession, in order to be able to defend us. At the present time somebody must be able to do this. But perhaps among the other factors which prevent war one could mention the outstanding skill and courage of our pilots.

Remember Sanya Grigoryev, the hero in V. Kaverin's "Two Captains"? Do you remember when he arrived in Ensk on leave and how the little boys followed after him, copying his every gesture and mannerism? Many young men have become pilots today possibly because they read "Two Captains" in their childhood and never forgot Sanya Grigoryev. I immediately thought of him when I was introduced to Aleksandr Mozgovoy, commanding officer of the regiment imeni Lenin Komsomol.

Lieutenant Colonel Mozgovoy appears to be in his early thirties. He gives the appearance of composure, but one senses in him a vast amount of energy! At certain moments he suddenly becomes like a little boy whose dream has come true. I once recalled to Mozgovoy that in the early days military aviation was considered to be a privileged branch of the military, which accepted for the most part aristocrats. Count Antoine de Saint-Exupery was a pilot. Ignacio Sinceros, commander of Spain's revolutionary air force, was a Spanish grandee, and French counts and marquis fought in the Normandie-Neman regiment....

"Too bad it was so extensively democratized," Mozgovoy unexpectedly declared. "Sometimes these types are just what the doctor ordered!" But then he looked at his own suit with irony and laughed mirthlessly: "Too bad I'm not an aristocrat!"

To tell you the truth, today's flight suits are not that attractive. Dark blue, of coarse cotton, they wear out rapidly, get dirty, and yet they are issued for three years. The suits worn by technicians are of the same fabric, but black, and issued for five years, and yet consider the kind of work they are doing! Can you imagine how they look? And yet these people are also officers!

There are also flight suits of a dirty-yellow color. Who chose that color? And yet foreign pilots look nice. They wear beautiful flight suits made of modern fabrics.

Incidentally, our pilots face much more difficult problems than this. (To be concluded)

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Barnaul Officers Propose More Efficient Aircraft Maintenance

90R90002F Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 2, Feb 90(signed to press 4 Jan 90) p 14

[Article in the form of a reader letter, published under the heading "Aviation Engineering Service: Problems, Inquiry, Solutions," by Lt Col G. Otrubnikovskiy, on behalf of the aviation engineering service officers, command element, Barnaul Higher Military Aviation School for Pilots: "The Right to Initiative"]

[Text] We read with interest the article by Regimental Deputy Commander for Aviation Engineering Service V. Panasyuk entitled "Figured and Actual Reliability" and the accompanying commentary by Candidate of Technical Sciences Col V. Zhidonis. The article addresses a very important problem—maintaining second-generation and third-generation aircraft at a specified level of reliability. The author correctly points to the poor effectiveness of the existing scheduled preventive maintenance system. The individual approach to estimating the level of reliability of each aircraft which he proposes is absolutely correct, for even if one assumes that it is approximately equal for different aircraft at the stage of development and manufacture, the diversity of effect of operational factors with the same total number of hours flown or the same duration of operation leads to a differing actual state.

Organizational and technical measures being carried out in this unit also merit attention. In this regard, however, we must agree with Col V. Zhidonis: it is impossible to reach a reliable conclusion on the need for and adequacy of preventive maintenance procedures without possessing an adequate quantity of statistical data. Our engineer and technician colleagues who did not send in a flood of letters (otherwise they would have printed them) on such a critical topic are also right. Two circumstances compelled us to take pen in hand: the second is stated at the end of this letter, while the first as is follows.

Operation and maintenance of early-generation aircraft, high intensity of flight operations, weak practical skills on the part of the student pilot, a varying level of aviation engineering support, as well as other circumstances characteristic of all flight schools compel the aviation engineering service at the Barnaul Higher Military Aviation School for Pilots to deal actively with matters pertaining to achieving a specified level of aircraft fleet reliability. Having received DVK-2M microcomputers four years ago, in 1988 we set up recordkeeping of the individual peculiarities of the aircraft of one Air Force training regiment. We developed and adopted the Dopusk [Certification] aircraft equipment integrated data management system. This system enables one to determine whether an aircraft should be certified as airworthy, on the basis of 26 different parameters, and monitors the promptness and timeliness of performance of periodic inspection and maintenance. The menu-driven application software developed by our people makes it possible to use the system without

special training. At the present time, with three microcomputers, we could keep current records on the specific features of each flight as well as other data directly affecting the condition of aircraft. In the future we shall be developing more sophisticated programs, which will evaluate the level of aircraft reliability.

Unfortunately, however, V. Panasyuk's method, just as our proposals, fails to solve the problem (it is apparently for this reason that so little is published on this topic). And the reason lies not in excessive simplicity of methodological approach, although this does occur, but lies rather within the system itself. Today the regimental deputy commander for aviation engineering service is unable to change or adjust servicing and maintenance procedures, and he is unable to move his maintenance personnel around. While the former is prohibited by NIAS-78 [Aviation Engineering Service Regulations-78], the latter is prevented by the aircraft maintenance technician's 14-hour workday. Is this not the reason why a person from the Aviation Engineering Service is a rarity among officer graduate students. The framework of the system prevents the young officer with a higher education, the flight school aircraft maintenance department instructor, and even the engineer who is a candidate for postgraduate study from utilizing his knowledge in a practical way. Servicing and maintenance procedures have been virtually transformed into a rigid law: dissent is stifled. At the same time the regiment's engineering supervisor personnel are directly responsible for ensuring that aircraft are in good working order and in a state of operational readiness.

Why not give this personnel greater authority, limiting it to the current table of organization structure and volume of work activities performed pursuant to RTE [Servicing and Maintenance Procedures]? And let the regimental deputy commander for aviation engineering service determine for himself how many technicians and mechanics he needs to service flight operations and how many he needs for preventive maintenance activities.

It is a known fact that taking into consideration a person's individual features significantly boosts his labor productivity. It would therefore be entirely logical, while continuing to be an aircraft technician according to the table of organization, for example, to have one technician spend the eight-hour workday performing scheduled maintenance on an aircraft in a considerably greater volume than specified by the Servicing and Maintenance Procedures, and at a higher level (the resulting freed-up time would enable him to improve his job skills), while another specialist would work on aircraft turnaround [readying for next sortie]. Personal responsibility would be assured, and maintenance intermediate inspection checkoff would be even more rigorous. The only addition would be establishment of a technical maintenance unit second complement, the personnel of which would perform precisely that preventive maintenance for the performance of which there is today essentially nobody available. This same personnel would be able, when

necessary, to beef up the air squadrons and first-complement technical maintenance unit.

The times require decisive restructuring of the aviation engineering support system: it should be more flexible and efficient. We believe that the approach we have proposed is at least to some degree superior to the scheduled preventive maintenance system and takes the human factor more fully into account. In order to prove in a practical manner the advantages of this proposal, we aviation engineering service officers at the Barnaul Higher Military Aviation School for Pilots propose that it be tested out in 1990 on our school's air regiment. There is no need for assistance "from higher up," neither financial nor moral assistance—we will handle everything ourselves. We need only approval from the higher echelon, since in order to perform the experiment we need to revise certain provisions of NIAS-78. This is the second factor involved.

We are waiting for approval from the magazine AVIATSIYA I KOSMONAVTIKA, since it has truly become a forum for perestroika in the Air Force (we hope that our proposal also constitutes a contribution to perestroika). We are also counting on the assistance of all interested specialist personnel and aviation engineering service officials, particularly the chief engineer of the Air Force, on whom the final decision depends.

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Military Personnel Legal Questions Answered

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in Russian No 2, Feb 90 (signed to press 4 Jan 90) p 15

[Article by Col Justice S. Kuznetsov: "Legal Consultation"]

[Text] We answer reader questions connected with study at military higher educational institutions.

* * *

V. Turchak: Our son has decided to get married after graduating from service school. Can his wife register to our address, and must she remove her residence registration status when, after our son graduates, she moves to his duty assignment location?

Answer: Pursuant to Article 29 of the Fundamental Housing Law of the USSR and the Union Republics, Article 60 of the RSFSR Housing Code and corresponding articles of the housing codes of the other union republics, housing is retained in the name of service school cadets for a period of six months after graduation. USSR Council of Ministers Decree No 678, dated 28 August 1974, entitled "Some Regulations and Procedures of Residence Registration of Citizens," specifies that in cities, towns, and urban-type communities a spouse is registered to the living space of the other spouse, regardless of the size of said living space. Upon moving to another locality for permanent residence, citizens shall register at the new place of residence.

Cadet A. Frolov: Prior to enrolling in service school I served one and a half years of compulsory active military service. During the second year at service school I requested to withdraw from school due to family circumstances. Will my time at service school count toward my total military service?

Answer: Pursuant to the Statute on Performance of Compulsory Active Military Service by primary-rank military personnel, noncommissioned officers and petty officers of the Soviet Army and Navy, which went into effect in 1984 by order of the USSR Minister of Defense, students enrolled at military educational institutions who are dismissed for academic deficiencies, for unwillingness to study, or for disciplinary reasons, if they had not completed their required term of active military service prior to enrollment, shall be assigned to duty in a military unit in order to complete the required term of active military service. After not less than six months of exemplary service, at the request of one's unit commander, by decision of the commanding general of a military district, fleet, independent army, independent flotilla, or equivalent, time of study at a higher military educational institution shall count toward active military service. For flight school cadets washed out of the program for failure to meet flying requirements (professional unsuitability), time at flight school shall be counted toward active military service.

A. Mironova: My son was dismissed from a higher military aviation school. Is he entitled to seek reinstatement in order to resume his studies?

Answer: Pursuant to the Statute on Higher Military Educational Institutions of the USSR Ministry of Defense (USSR Minister of Defense order, 1982), students may be dismissed from military higher educational institutions for the following reasons: —failure in examinations in three or more subjects, or failure to make up an academic deficiency within the specified time; —failure to pass state examinations in one or more subjects or a grade of unsatisfactory on one's senior thesis (project, problem); —indiscipline, unwillingness to study, or illness which prevents one from successfully completing a course of study (based on the findings of a military medical board).

In exceptional cases, persons dismissed from the second and subsequent years of study at a military higher educational institution for academic deficiency, for disciplinary reasons, or for unwillingness to study, may be reinstated in the appropriate year of study at that same military higher educational institution on petition by one's unit commanding officer or the military commissar at the locality of one's residence, under the condition of exemplary military service or a positive character reference from one's place of employment, after not less than one year of military service or employment following dismissal, and if not more than 3 years have passed since dismissal. The decision on reinstatement shall be made by the officer in charge of the

military higher educational institution. Persons dismissed from the first year of study may be accepted to military higher educational institution enrollment only on a general-consideration basis, in conformity with the regulations governing acceptance to higher military educational institutions of the USSR Ministry of Defense.

Officers and warrant officers dismissed from the second and subsequent years of a given curriculum may be enrolled, on petition by their military unit commander, in the corresponding year of study in the correspondence curriculum, if not more than three years have passed from the time of their dismissal.

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Restructuring of Civil Aviation Outlined

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pp 16-17*

[Article, published under the heading "Anticipating the 28th CPSU Congress," by Mar Avn A. Volkov, Minister of Civil Aviation USSR: "Time of Great Changes"]

[Text] Every year on this date, 9 February, civil aviators look back to that distant year 1923, which was an important landmark in the history of Soviet aviation. It was at that time, 67 years ago, that the Labor and Defense Council voted to establish a Civil Aviation Council, which laid down the first organizational foundation for today's twice-decorated Aeroflot. The workers of our industry are very proud of the fact that this historic governmental enactment was adopted at the initiative of V. I. Lenin. Since that year 9 February has been considered the official birthday of Aeroflot.

Our country's first regular air service route was established that same year, 1923. It was established by pilot Ya. Moiseyev, a combat veteran of the Civil War, between Moscow and Nizhniy Novgorod (former name of the city of Gorkiy). The pilot flew at a height of 250 meters above ground level, and the flight took three and a half hours. Six passengers were delivered from Moscow to the destination city. A total of 229 passengers and approximately two tons of freight and mail were flown on Civil Air Fleet aircraft in 1923. Such figures seem minuscule today, when we fly more than half a million passengers every day to various destinations, but it was a significant achievement at the time.

Civil aviation has gone through various stages in its development. In spite of all the difficulties and setbacks, however, it gradually moved forward and was transformed into a branch of the economy without which it would be impossible to imagine life in this country today. Suffice it to say that last year alone more than 125 million passengers and more than 20 million tons of priority cargo and mail were hauled by air. In addition, airplanes and helicopters are actively utilized in agriculture and forestry, help in construction of oil and natural

gas pipelines, in building rail lines and power transmission lines, take part in scientific research, in exploration and exploitation of the Arctic and Antarctica, conduct fishing reconnaissance, perform emergency medical airlifts, and do a great many other jobs. The oil and gas fields of Tyumen would scarcely have been explored and developed so rapidly without the assistance of civil aviators; the same applies to construction of the Baikal-Amur Mainline and settlement of the vast expanses of the Far North and Far East. Aeroflot international service is also growing vigorously.

We presently operate regular air service to and from almost 100 countries in Europe and Asia, North and South America, and Africa. Aircraft bearing the Soviet airline's winged logo land in 126 foreign cities.

We must note that at all stages of its development civil aviation has relied on the experience, know-how, and considerable practical assistance of military aviators.

As we see, civil aviation plays an important role in many domains of our society's affairs. Major restructuring is needed, however. The times are imperatively demanding that we rethink a great deal of what aroused no doubts in the past and was considered faultlessly valid.

Take the main problem—meeting the air service needs of the economy and the Soviet public. On the one hand we are achieving unquestionable success. Eloquently attesting to this is the steadily growing volume of air transportation and the use of aviation in the economy. On the other hand there is a chronic shortage of airline tickets and a shortage of airplanes and helicopters for performing important economic tasks. According to calculations by our experts, each year Aeroflot turns back 15 million potential air passengers.

This magazine's readers, especially those stationed in the Far North, Siberia, and the Far East, have personally seen time and time again how difficult it is to obtain airline tickets. And this causes understandable indignation and resentment on the part of Soviet citizens. And poor quality of passenger service is closely linked to failure to satisfy demand, for the shortage of airline tickets inevitably engenders a shortage of sensitivity and attention on the part of those airline personnel whose job it is to care for their customers. Thus a vicious circle begins, from which one cannot always escape.

Aeroflot's international operations are also cause for serious concern. It was not so long ago that we were confidently advertising our "unobtrusive but lavish service" on foreign flights, but today we are encountering with increasing frequency the regrettable fact of loss of Aeroflot's ability to compete and loss of its prestige and reputation in the eyes of the flying public abroad. It is no mere accident that our country is somewhere between 11th and 20th in volume of international air service.

I am saying this by no means because it is fashionable to do so, as is sometimes the case in this country, for the fact is that the atmosphere of democratization and

glasnost, in addition to positive trends, has also engendered the phenomenon of faultfinding and excessive criticism, an endeavor on the part of certain "champions of the truth," both persons with and without an involvement in the thing being criticized, to emphasize how wonderful everything is "over there" and how terrible everything is "here in our own country." No, I am moved by a quite different motive: to give an objective appraisal to the state of affairs in the air transportation industry. And a quite logical question arises in connection with this: what are the reasons for this difficult, complex situation, and is there a realistic solution?

First and foremost, civil aviation is faced with the most acute problem of upgrading and refurbishing its fleet. Today more than 80 percent of air service is being flown by aircraft built in the 1960s and 1970s. In many regards, particularly economy and comfort, they are far from meeting today's demands. But unfortunately our aircraft industry is far behind in delivering new aircraft.

Figuratively speaking, Aeroflot would breathe a sigh of relief if it were able to obtain such aircraft as the Il-96-300, Tu-204, and Il-114. They are superior in specifications and performance to the aircraft which are presently in service and could greatly ease our situation. But the problem is that the aircraft industry will not be able to deliver us these aircraft before the mid-1990s, and yet we are urgently in need of them right today. Even our hopes for partial conversion of the aircraft industry and its reorientation toward the needs of the civilian economy are small consolation, since time has already been lost. Incidentally, we are expecting a good boost for our flight and technical services through the hiring of Air Force personnel being discharged as a result of the reduction of military forces.

We see as a way out of this difficult situation augmentation of Aeroflot's fleet by purchasing aircraft abroad. Not so long ago this suggestion would have been rejected out of hand. Since when is this great aviation power going to bow down to the foreign aircraft industry? But fortunately perestroyka is smashing the fetters of dogmatic thinking and opening up the way for economic initiative and enterprise.

There is also another way out of this impasse: lease or joint operation of foreign aircraft. The first such venture of this type has been entered into with Pan American, in partnership with which Aeroflot is flying the widebody Boeing 747 in service between Moscow and New York. And although the mechanism of such interaction between two airlines has not yet been fully perfected, one should not reject such a practice out of hand.

There is another, no less important problem which is holding back the growth of air service: it is the provision of "land." Air transport is badly in need of air terminals, maintenance hangars, in-flight meal catering and preparation facilities, hotels, and other facilities. Even what would seem to be such a modern airport complex as Sheremetyevo-2, built only 10 years ago, is unable fully

to satisfy the demanding taste of the flying public. This is why we are working aggressively to improve Aeroflot's facilities.

One way to achieve this goal is to establish joint ventures with foreign companies. Such ventures are already operating within the Central International Air Service Administration and the Civil Aviation International Commercial Administration. The revenues generated by their activities will help us get moving with construction of many facilities which determine Aeroflot's production and management activities and level of passenger service.

We are also doing a great deal to improve the structure of civil aviation. Transition by this branch to economic accountability has placed on the agenda such problems as expanding the economic-management independence of aviation enterprises and rejection of command-coercive methods of management. In the past the ministry frequently exercised supervision over subordinate workforces even in trivial matters, while today it deals only with large-scale problems; everything applying to handling specific matters of economic management has been transferred over directly to the enterprises. This redistribution of functions among the ministry and production subdivisions is totally in conformity with the spirit of reform being carried out in this country and presumes exclusively economic rather than administrative methods of handling their mutual relations.

In conformity with the new structure of civil aviation, basic changes will apply only to such a fundamental production element as the territorial administration. Wherever it is economically feasible, aviation companies, associations, and other new structural units will be formed, based on the present administrations. And this is not merely a relabeling. We are talking about a fundamental restructuring of the system of management of air transportation. Aviation companies, in contrast to the previous territorial administration, will enjoy full autonomy and carry out their activities exclusively on the basis of economic accountability, self-financing, and autonomous management. And the existence of several aviation companies within the structure of this country's civil aviation will present a strong obstacle to monopoly in air service and the employment of aircraft in the economy, and will create a realistic foundation for healthy competition.

As for the ministry's administrative structure, it will also undergo significant changes. First of all, there will be a reduction in staff. Second, it will perform only functions of governmental administration, not economic management. Its main concerns will be formulation and execution of strategy of development of the air transportation branch taking into account the nation's economic goals and worldwide experience, improvement of scientific and technological potential, handling of matters pertaining to flight safety, formulation of air transport standards, and training of personnel.

Major restructuring is also to be accomplished in other aviation industry structures. Specialized centers will be established for servicing and maintenance of aircraft based on advanced processes and technologies, as well as further development of airport complexes, improvement of air traffic control services, etc.

Radical restructuring is also to take place in science and civil aviation educational institutions. School personnel assignment will henceforth be done on a contractual basis. Enterprises will determine their requirements in specialist personnel of various specialization areas, will submit an appropriate request, and the schools will meet these requests. This system eliminates the training of excessive numbers of specialist personnel and provides guaranteed employment. As many other things, this is not a very conventional procedure, but it is essential.

As regards new scientific innovations, they are also determined by economic-accountability relations with the clients.

In short, civil aviation is presently going through a stage of major changes. These changes encompass virtually all areas of civil aviation activity: economics, science and technology, organization and execution of flight operations, servicing of passengers and clients, personnel training, plus many other things. We must state that this is a complex phase. It requires revising traditional approaches and rejection of obsolete stereotypes and schemes. It requires constructive and bold solutions. And there is full confidence that the people in civil aviation will prove to be up to the tasks advanced by perestroika, will successfully meet the plan targets for the 12th Five-Year Plan, and will greet the 28th CPSU Congress in a worthy manner.

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Journalists To Be Selected For Space Flight
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[Article, published under the heading "Project Space for Our Children," by S. Skrynnikov: "I Want to Stride Into Orbit"]

[Text] More than half a year has passed since establishment of the USSR Union of Journalists Commission on Space. Thousands of Soviet citizens have applied to go along on a space flight before it was even known whether a final favorable decision would be made. The space flight training program has now become reality, as was confirmed by Mikhail Sergeyevich Gorbachev at an October 1989 get-together with the staff of the newspaper PRAVDA. A thorough candidate screening and selection process is underway. AVIATSIYA I KOSMONAVTIKA correspondent Sergey Skrynnikov was a member of a small group of persons who went through the first phase of medical examination.

Sergey is a graduate of Moscow State University. He is known to our readers as a photocorrespondent who flies aboard modern aircraft. He is acquainted with G forces and with the incomparable sense of height. This journalist has provided our readers with coverage from the Cosmonaut Training Center imeni Yu. A. Gagarin and from the landing sites of cosmonauts returning from long orbital missions.

Now Sergey Skrynnikov himself is standing practically on the threshold of space. He wants to stride into orbit in order to....

* * *

As I look at photographs of the Earth taken by cosmonauts, I recall their statements that from orbital altitude our planet appears small and fragile. More and more frequently I think about the fact that so much grief and unhappiness still exists on the earth! Fire, blood, violence, tears.... But perhaps the most terrible thing in this chaos of Horror, which has not yet been reined in by common sense, is the growing number of bright-eyed little children who are defenseless in the face of Evil. Those who see in their dreams not carefree games in a magical, sun-drenched glade, but rather a crust of dry bread as a symbol of Great Virtue or the warm, gentle, welcome, precious hands of a mother they have never even seen—as a symbol of impossible and therefore unexhausted Happiness. These children's eyes seem to ask: what have you personally done to help see that there will no longer be deprived, hungry, crippled children, deprived not only of the right to a happy childhood but even to the chance of elementary physical survival, on our unfortunately still cruel and sinful earth?

This is why I wholeheartedly welcome the idea of a Soviet journalist going into space under the auspices of the Space for Our Children program.

The first and most important goal I set for myself, if I am fortunate enough to be able to stride into orbit, is to campaign actively and vigorously for a world in which all the earth's children take joy in the sun, the sky, the stars, that there be Happiness in their eyes turned toward the heavens, rather than an entreaty for mercy. I know that this task is not easy and that it is a task of great responsibility, but there is no other way to achieve victory by Good on our little planet in this vast Universe.

...At the time the first group of winners of the creative-achievement competition for acceptance to the first, medical examination phase, was being determined at a meeting of the Space Commission, I was on an assignment: I was preparing an article on the 30th anniversary of the Cosmonaut Training Center imeni Yu. A. Gagarin. In one of the classrooms there was a class in session with future Japanese cosmonauts.

Tokyo TV reporters Ryoko Kikutsi and Toyohiro Akiyama were taking their first steps toward learning Russian. You should have seen with what assiduous

effort my foreign colleagues read aloud, syllable by syllable: "Moscow is the ca-pi-tal of the USSR!" I asked them to write something in Russian. Ryoko Kikutsi went to the blackboard and proceeded to write: "I want to fly into space." The teacher helped him correct his mistakes and called Toyohiro Akiyama to the board. Furtively glancing at the preceding sentence, he wrote: "I also want to fly into space."

"Lucky guys," I smiled to myself. This was followed by the somewhat sad thought: "Too bad that a Soviet journalist will not be the first into space. We have here a genuine case of shoemaker without shoes of his own." At that time I was not yet aware of the fact that the USSR Council of Ministers Military Industry Commission and top officials at the Ministry of General Machine Building had instructed the Union of Journalists to perform a tough task, but one which we had long awaited: to select a group of candidates in short order.

It is true that I am now realizing more and more that it is a matter not only and perhaps not so much of prestige as to who will be the first journalist in space. But it is unquestionably logical that he should be a Soviet, for this is a wonderful opportunity to open the eyes of our people, so to speak, to the space program. For this reason the second task I am setting for myself is to endeavor to change the erroneous opinion according to which space exploration is nothing but an expensive prestige toy. Behind the veil of secrecy people should finally see the real future of this endeavor, on which money is being spent, and understand the truth: space promises not only spiritual healing but also definite material benefit.

There is also another stereotype which I strongly feel should be combated. As I was preparing an article on the landing of the Soviet-French crew, I unexpectedly discovered a major injustice, expressed in a narrowly-focused sensation-oriented interest only in the crew members themselves, with total indifference toward the thousands of specialist personnel who literally nurtured the spacecraft with their own hands, who provided mission support and, finally, supported the deorbit and landing. Why are they being ignored by the reporters?

For some reason, over the 30-year history of the space program we have been acquainted only with a limited number of individuals, to whom books and films have been dedicated. These are for the most part those persons who have actually flown in space. And we must admit that they have been presented to us as darlings of destiny, bathing in the brilliant rays of fame and Heroes' Stars, for the rest of their lives reaping laurels of a fortunate confluence of circumstances. And one hears more and more persistently the sarcastic, envy-filled voice of the embittered public: cosmonaut, they say, is the profession of Heroes of the Soviet Union!

Nor is this surprising. We journalists have created a cavalier mythic fairytale world around the space program. What is needed is a truthful presentation of that

colossal labor, those enormous psychological and physiological stresses, those foul-ups and problems which fall to the lot of earth's emissary in space. He is by no means a darling of destiny, but rather a remarkably hard-working individual. He is a person who dedicates himself entirely to his chosen endeavor, in short, a professional with all the demands on the individual which proceed from this fact.

I have a cherished dream: to discover my own "journalist's cosmos." Not robotized and cold, like the luster of lifeless metal, but living, human. Rejecting stereotypes and customary notions, I want to use truth as a basis, to relate and show that which nobody but you yourself will say. Be it an album of photographs, a TV presentation, or simply an honest statement by an eyewitness. He of us who is first to stride toward the stars bears an enormous journalistic responsibility: to amass the ideas of thousands of his colleagues.

American teacher Sharon Christa McCauliffe paid with her life for the dream of teaching a geography lesson from orbit. "It is a matter of our honor," stated KOMSOMOLKA correspondent Yaroslav Golovanov, "to conduct such a lesson for the children of the entire world, in honor of the tragic crew of the Challenger. This is not my idea, but if I am fortunate enough to go up, I shall do everything I can to carry it out."

I would like to say one more thing. We have become accustomed to struggling, pushing forward, breaking our way out, and standing ground our entire lives. It is probably for this reason that as I underwent a medical examination at the USSR Ministry of Health Institute of Medicobiological Problems, I was amazed at the general kindness and mutual assistance both on the part of my colleagues, finalists in the space competition, and by the institute's medical personnel.

My colleague was relating to the nurses who were taking an EKG how he had met a person with two hearts. The girls did not believe him and smiled, somewhat embarrassed. But a doctor came to my colleague's aid, confirming that persons with two hearts have indeed been recorded in the annals of medicine.

One of the journalists, apparently trying to hide his nervousness, suggested conducting an experiment. "Chumak [name of well-known 'wonder-worker' healer] lives in my building. What if I come back for another medical examination after a charging-up session with him? Will the results be different?"

I too was a little worried when I was unable to read the bottom line on the eye chart. But the doctor, Mikhail Petrovich Kuzmin, calmed my anxieties, assuring me that I had good vision, and then added with a smile: "Amazingly enough, almost all the journalist candidates have very good eyesight. I guess it is not surprising: during the period of perestroika journalists should have acute vision."

In their conversations with us the doctors recalled the first cosmonauts, as well as those who have recently been examined by the medical board and who are currently in orbit or are preparing for a mission, speaking about them as if they were their favorite children. These recollections contain something of the village mother who, after raising her children, spends the rest of her life waiting for that letter from them which never comes. Don't forget this, you who began your journey to the stars here!

The Space for Our Children program is in operation. A special bank account has been opened, Account Number 707101, into which contributed money will be deposited, funds of which the unfortunate are so much in need. But the point is not even the money. The main thing is that recently we have become more acutely aware of the pain of others, including our children. And I am sincerely proud of the fact that I am taking part in such a highly-humanitarian undertaking. I am confident that I shall find many others of like mind among Air Force personnel, unselfish and open individuals. Winged knights, the children await our help and protection!

* * *

Editor's Note: At the author's request, the payment for this article is going to the "Space for Our Children" Children's Fund, Account Number 707101.

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Comments on New Aircraft Maintenance System

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[Article, published under the heading "Innovations in Aircraft Maintenance," by Lt Col S. Karpovich and Lt Col B. Magnitov: "Why Is the 'Experiment Skidding'?"]

[Text] In our daily work we are directly involved with the development, certification, and adoption in line units of the new system of aircraft servicing and maintenance by combined teams. For this reason we could not be indifferent to the article "Why the Experiment Is 'Skidding'" (AVIATSIYA I KOSMONAVTIKA, No 9, 1989). And the point is not only that, as we see it, its authors (one of whom, incidentally, is an air regiment assistant aviation engineering service chief) do not quite correctly grasp the essence of this new innovation. Unfortunately higher-ranking engineering-technical supervisor personnel also have a faulty perception of it to one degree or another. The problem is that, due to a lack of understanding, the new system is being adopted and brought on-line in the units in a distorted form. And all the shortcomings and problems in the operations of these units, which have accumulated over the course of years, are ascribed to the new system.

First of all we must state that adoption of new forms and methods of aircraft maintenance has already gone beyond the experimental stage. Following studies and

verification in frontal-aviation units, the new system has been formally adopted via an official order.

This comment is important because some persons in authority, viewing it as an experiment, are subjecting it to review and are attempting to reformulate the finished points of the system to their own view. This discredits the very idea of reorganization of the aviation engineering service and provides a basis for unwarranted conclusions that it is premature.

And yet transition to the new system is one of the basic directions being taken by perestroika in the Air Force. And, just like any other innovation, this process requires a radical breaking of established stereotypes and obsolete standards.

Just what is the essence of the basic mistakes on the part of engineer-technician personnel at the present transition stage?

Analysis of the activities of Air Force personnel revealed various types of difficulties which they encounter. Objective difficulties, for example, include a low actual percentage of specialist personnel on servicing teams. Hence the opinion crops up that the aviation engineering service T/O structure being adopted is becoming more "rigid" in comparison with the servicing and maintenance groups in the air squadrons, that is, the structure makes it impossible to achieve working efficiency if certain persons are lacking on the servicing team.

But does the "old" structure, with the existing shortage of specialist personnel, not contain the same deficiency? After all, the absence of even one specialist would result in a halt to the entire process flow of readying aircraft and would make it impossible to observe the legitimate requirements of guideline documents.

In such a case, how can there be proper aircraft maintenance, proper work procedures, and proper quality of work performance and performance verification? There is no possibility here of thorough analysis of the condition of assemblies and components, instruments and equipment; the main thing is to get the signoffs for work performance and for job completion inspection.

The primary purpose of the new system is to ensure proper aircraft maintenance. This system prohibits preflighting aircraft by servicing teams on which the number of specialist personnel is smaller than the number of routings for the specific type of preflighting for a specific flight. It precisely and unequivocally defines the minimum requisite makeup of the maintenance team. This provision effectively blocks the diversion of engineer and technician personnel, during a period of flight operations, to various work activities not connected with their direct job duties. If unit leaders schedule the required number of aircraft for a flight operations day, now they must distribute both flight and

engineer-technician personnel. Particularly since operations under the new system do not introduce any limitations to flight personnel pertaining to flying any aircraft of any servicing detachment.

Thus inadequate staffing of unit aviation engineering services is a chronic ailment. And the fact of a new system is irrelevant. It is just that in the period of glasnost it has shown up the existing problem in higher relief.

Now for the subjective causes of the mistakes which occur. In our opinion they are grounded on an incorrect notion of maintenance in the future. It is high time to grasp the fact that the higher level of integration of equipment carried by aircraft now entering service, as well as the complexity of these aircraft, demand the establishment of a system which should be formed not according to specialization but by function. It should contain subdivisions for preflighting aircraft and subdivisions performing preventive maintenance, the extent of which is determined on the basis of data recorder analysis.

The first stage in improving the system of aircraft maintenance was the establishment of combined servicing teams. Its further development will inevitably proceed in the direction of improving the air regiment's technical maintenance unit and transition to aircraft maintenance based on condition.

The introduction of servicing teams resolves not only the problem of maintenance of integrated onboard systems but also substantially increases the capabilities of the maintenance system. Independent aviation engineering service subunits are capable of preflighting any number of aircraft, which is particularly important when conducting combat operations in conditions of maneuver of men and equipment. This is confirmed by field exercises and operational readiness tests.

Now a few words about the makeup of servicing teams. It is sometimes claimed (so claim the authors of the article cited above) that at the servicing-team level there is lacking the traditional division into specialists in avionics, aircraft equipment, aircraft armament, and particularly into aircraft technicians [ground crew chiefs]. This is not entirely correct. The team is a combined entity and, in conformity with the principle of general specialization adopted in the Air Force, it contains full representation of airframe and powerplant specialists, aircraft armament specialists, aircraft equipment and avionics specialists. As for the aircraft technician, requirements on him as the aircraft's "master" are increasing under the new system, and one can scarcely overstate his role in the preflighting process as the principal person who checks and verifies completeness and quality of performed work.

A high level of professional ability and skill on the part of each servicing crew specialist is a principal and essential condition for functioning of the new system. In order to create professional potential and to maintain it at the

required level, the positions of engineer in the appropriate areas of specialization are prescribed in the aircraft servicing detachments. This category of engineer-technician personnel has the task of maintaining the required level of knowledge and skills on the part of servicing crew specialist personnel and exercising technical oversight over aircraft servicing and maintenance procedures in their area of specialization. Naturally the role of engineering-technical training of unit specialist personnel increases considerably thereby.

For this reason it is incorrect to maintain that servicing crew members now service only a specific maintenance routing, rather than aircraft equipment, armament, or aircraft systems. Each servicing crew member is first and foremost a highly-skilled specialist. Only during aircraft preflighting procedures, post-mission aircraft servicing and turnaround is this specialist instructed to perform procedures following his integrated maintenance procedures routing. All other work on the aircraft, removable equipment, test equipment, and specialized ground servicing equipment is performed by crew members on the basis of their own specialization area. Correction of detected malfunctions is performed in the same way, of course with the active participation of all team personnel and, if required, detachment engineers and air unit technical maintenance unit specialist personnel are also brought in.

As experience has shown, in order to achieve full personnel interchangeability, every crew member should be cross-trained to handle three or four integrated maintenance procedures routings. This will eliminate so-called "tie-down" and limitation of individuals to a specific integrated maintenance procedures routing. The integrated team chief will be able to maneuver his men around when needed. This ensures crew stability and viability.

They are proceeding incorrectly in those units in which a maintenance team specialist is personally assigned to a specific routing, automatically making him responsible for the condition of that equipment which he inspects when working on a maintenance routing basis. This approach leads to a downward leveling of knowledge on the part of engineer-technician personnel and a decline in their professional skills within their specialization area. As a result we obtain a so-called full conversion to routing: we have a specialist for a specific maintenance routing sequence, but no specialist in a specific specialization area.

They have proceeded further in the units with which officers I. Bovsunovskiy and V. Yevstafyev serve as aviation engineering service supervisors. They have added to each team a non-T/O integrated bombsight and targeting navigation system (PNK) specialist, although he is not prescribed by the TOE. Now nobody except for this specialist can perform work on the required routing sequence or correct malfunctions in the bombsight and targeting navigation avionics, nor does anybody else want to, for the team now has a "scapegoat," and the

maintenance team chief, who has both authority and subordinates, is not responsible for the overall system, but is rather a person without authority but with assigned responsibilities.

This approach to handling the problem of PNK maintenance is contrary to a fundamental principle of the new system—uniformity of work-loading and responsibility of team members. One should be clearly cognizant of the fact that any addition of non-T/O positions to the integrated servicing and maintenance team attests to incomplete utilization of this subunit, which on the basis of makeup of specialist personnel comprises that same systems (the entire aircraft is viewed as a system) group as the former bombsight, gunsight and targeting navigation systems maintenance group. Equipment should be distributed and assigned to team members on the basis of specialization area and in conformity with the requirements of the new guideline documents pertaining to organization of maintenance of integrated bombsight and targeting navigation avionics.

One should bear in mind that unit and detachment specialization-area engineers exercise, via the team chiefs, technical supervision over servicing and maintenance of the integrated package systems in conformity with distribution of equipment, while overall technical supervision of servicing and maintenance of the integrated system as a whole is handled by the unit and detachment engineers for PNK.

This organization of PNK maintenance removes "obstacles" caused by personal routing sequence assignment of specialist personnel. In the course of their daily work team members familiarize themselves with the system phase by phase. And they are successful. Attesting to this, for example, is the work experience of the maintenance teams of the unit aviation engineering service headed by officer P. Bogatyrskiy (he was recently promoted).

The incident involving Lieutenant Ignatov cited in the article confirms that he was personally assigned a maintenance routing sequence which he had mastered, and he was automatically required to perform duties which formerly had been performed by PNK maintenance group specialists. But he was simply not prepared to do so, nor is this required of him, since this officer is a specialist in aircraft equipment and is responsible for only those systems within the integrated package which apply to his specialization area. Working by maintenance routing sequence, however, he must master only equipment inspection and testing procedures in a cross-trained specialization area.

Experience in working with the new aircraft maintenance system has shown that primary and main emphasis in training maintenance team specialists should be placed on their specialization, and on this foundation performing job-specific training in the appropriate maintenance routing sequences.

An important role in this is played by detachment engineers as practical training instructors. One can still hear comments in the units to the effect that the detachment engineers are "superfluous": they have no subordinates, and they do not take part in the aircraft pre-flighting processes. Hence the approach to their work assignments: details, administrative work, TDY assignments, and at best they become T/O specialists in maintenance problem troubleshooting. In taking such a position, in these units they are, figuratively speaking, robbing Peter to pay Paul. In the new system the engineer is closer to the equipment and to the men than at any time in the past. It is precisely this element of the unit aviation engineering service that is responsible for keeping aircraft continuously in good working order and in a continuous state of operational readiness.

This is the main function of aircraft servicing and maintenance detachment engineers. The introduction of these positions has made it possible to resolve the difficult problem of distributing graduates of Air Force higher educational institutions. Now they can be assigned to primary engineer slots.

The domain of engineer activities has considerably broadened in connection with the fact that maintenance routing sequence procedures are integrated, that is, they include elements of all specialization areas. Now each engineer is responsible for technical training and instruction in his specialization area not only of "his own" specialist personnel, as was the case in the past, but for the entire engineer-technician personnel of the detachment and unit. This requires a high degree of competence, knowledge, and ability. The fact is that not all unit and detachment engineers are fully prepared to work under the new system. Many have yet to perceive their role and function. The sooner this happens, the sooner the "skidding" phase will come to an end.

In our opinion these are the principal deficiencies in the work performance of engineer-technician personnel. This is the main reason for problems with the new system of aircraft servicing and maintenance. Wherever people continue working in the old manner, while in the guise of the new, they will inevitably encounter these difficulties, which are simply impossible to overcome without radically eliminating the old, accustomed ways.

The requirements of documents, presently being drafted, which determine the level of professional skill and proficiency rating for engineer-technician personnel, are also focused on working in the new manner. These documents impose on team members, in addition to knowledge of the aircraft they are maintaining and skills in their specialization area, additional demands pertaining to number of mastered integrated maintenance procedures routing sequences. All this will make it possible in a practical manner to expand the area of activity of aviation engineering service specialists, freeing them of monotonous labor and giving each individual the opportunity more fully to utilize his individual abilities. Here too we are in full agreement

with the view of Lt Col L. Komarovskiy, which is cited in the article "Why the Experiment Is 'Skidding,'" and with other aircraft maintenance specialist personnel who are against drawing premature conclusions based on emotions. Feedback, grounded on ensuring proper aircraft servicing and maintenance, should operate in this system, just as in any other. It is the task of feedback to remind us of the maximum capabilities, from the standpoint of applicable rules and principles, of the system and the people who keep it operating.

Of course engineer-technician personnel cannot solve all problems with their own manpower and resources. Real restructuring in the Air Force has only just started. Its success will depend on each executing individual, leader, and commander. For this reason thorough study of the new system of aircraft maintenance, analysis and assimilation of its essential points, assignment of specialist personnel exclusively on the basis of their professional abilities, as well as rigorous and precise observance of the requirements of guideline documents are the main elements on the road toward adoption and mastery of the new system.

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Designer of K-36 Ejection System Interviewed

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[Interview, published under the heading "Topic Suggested by a Reader," with Hero of Socialist Labor Professor G. I. Severin, doctor of technical sciences: "Degree of the Unknown"]

[Text] Officers V. Velikanov and Yu. Kuzmin are interested in the history of engineering and development of crewmember rescue and survival systems and have requested that we discuss the developers and testers of this equipment. AVIATSIYA I KOSMONAVTIKA special correspondent Lt Col V. Dolgishev visited a unique enterprise—the Zvezda Machine Building Plant. He interviewed Hero of Socialist Labor Professor G. I. Severin, doctor of technical sciences, Lenin Prize recipient, chief designer of life-support, rescue and survival systems.

* * *

[Dolgishev] Gay Illich, for a long time you were a "classified" leading Soviet designer of aerospace life-support, rescue and survival systems. I believe your name was first mentioned in the press in connection with the "unscheduled demonstration" of the K-36 standardized ejection seat during the mishap with the MiG-29 fighter at the 38th Paris Aerospace Show at Le Bourget. The "Soviet superseat," to quote the apt expression used by the French newspaper FRANCE SOIR, worked beautifully in a difficult situation and saved the pilot's life. Interest in this incident is quite understandable. Let us return to it, if you have no objection.

[Severin] Test pilot Anatoliy Kvochur from the Mikoyan Experimental Design Bureau was flying a slow-speed demonstration pass at a height of 150 meters. In this flight configuration, which is close to critical, the MiG ingested a bird, which was subsequently confirmed by a spectrogram of the damaged turbine blades.

...There was a flash by the starboard-engine tailpipe. The fighter yawed right. Its right wing stalled, and it plunged groundward. Videotapes show Anatoliy Kvochur in the cockpit preparing to eject, after which the canopy separates from the MiG, which has entered its final steep dive, and after this the ejection seat is thrown out sideward and slightly downward, at a slight angle to the ground. The tape shows that the ground is dangerously close. A tragic outcome appears inevitable. The parachute opened literally a few meters from the ground.

"A fantastic survival system," wrote the newspaper FIGARO, "saved the pilot's life." The aircraft was slightly more than 90 meters above the ground at the moment of ejection (for comparison, the height of a 22-story building is 70 meters), and the aircraft's rate of descent was about 50 meters per second.

Incidentally, there were also other assessments of the incident. Some foreign publications even surmised that the MiG-29 mishap was a deliberate action by the Russians to publicize their ejection seat. They failed to mention that this "publicity" cost us 20 million dollars—this is the Western estimate of the cost of a modern supersonic MiG-29 fighter. The cost of our ejection system in monetary terms is of course incomparably smaller than this impressive sum. We should note, however, that the true value of the ejection system is incomparably greater—a human life.

I might also quote the Associated Press, which summarized, as it were, the discussion of this incident: "The Soviets were even able to profit from the MiG-29 accident on the opening day of the air show. The aircraft's pilot, Anatoliy Kvochur, became the hero of the day, and the ejection seat, which enabled him to eject safely in such an extreme situation, attracted the attention of industrial circles as an example of the latest technology."

Aviation specialists from many countries and companies constantly crowded around the display stand in the exhibition hall where our ejection seat was on display. Their interest was evoked not only by what had happened at Le Bourget but also by the fact that this system, which is in regular production and is used on virtually all our modern aircraft, and is also installed (of course in modified form) aboard the Buran, provides a higher level of crew survival probability than counterpart systems built by Western companies. It is not surprising that specialists from many countries who are involved in the development of recoverable space systems took a serious interest in the K-36 L (light) ejection seat.

[Dolgishev] Could you tell us something about the development of the standard ejection seat, designed for safe

crew recovery in a broad range of emergency situations? I guess what we need is a brief historical presentation.

[Severin] Of course the first known "flying machine" device which would allow a person to descend safely from a great height was proposed by Leonardo Da Vinci back in the 15th century. Intensive development of rescue and survival systems commenced when men took to the air. French physicist Lenorman built and tested a "device against falling" specifically to be used in balloon mishaps. He called it a parachute (from the Greek word "para"—against, and the French word "chute"—falling).

This survival device was undeservedly relegated to oblivion when the first heavier-than-air craft appeared. Pilots simply refused to take seriously the balloonist's parachute. Some doubted the possibility of its practical application, while others believed that a fatal outcome was inevitable if an in-flight emergency occurred. Famed aircraft designer and pilot Gabriel Voisin stated, for example: "Nothing can be done to prevent an air accident."

Attainable aircraft speed and altitude were increasing rapidly, but the number of aviation fatalities was also growing. One person was killed in 1908, an American by the name of Selfridge, who had flown with Orville Wright in the latter's airplane. His was the first name on the list of persons killed in air mishaps, which aviation magazines began publishing annually: three aviators perished in 1909, and 32 in 1910. Publication of these lists soon ended, since the number of fatalities was growing rapidly.

Russia's first aviation fatality was Capt Lev Matsiyevich, one of Russia's first pilots. The tragedy occurred in September 1910 during celebration of All-Russian Aeronautics Day at the Komendantskiy Airfield. Gleb Yevgenyevich Kotelnikov, a 39-year-old actor from the Narodnyy Dom and a former artilleryman, was also present that day, accompanied by his wife. The aviator's death affected him deeply. Kotelnikov proceeded to give serious thought to the matter of how such tragedies could be prevented in the future and how to make airplane flight safe. The several dozen parachute designs which existed at that time offered no such guarantee: they were very unwieldy and inconvenient, and they usually were not worn but kept tucked away in the cockpit.

Gleb Yevgenyevich worked on his design for almost a year and came up with a fundamentally new solution—the parachute should be worn at all times by the pilot, should not take up much room, should not impede the process of flying the aircraft and, of course, should be absolutely reliable. In implementing this idea, he designed a metal backpack, on the floor of which he placed steel springs covered by a metal plate. A parachute canopy sewn of lightweight fabric was placed in the pack. In 1912 this Russian inventor was issued a patent on his "rescue pack" for aviators with automatically-ejecting parachute. This was the world's first pack-type

parachute designed to save aviators' lives in case of an air mishap. Subsequently many parachute systems were developed in the USSR and in other countries, and all were based on the same principles which were laid down by Gleb Kotelnikov at the beginning of the century.

[Dolgishhev] But then jet aircraft appeared on the scene at the end of the 1940s....

[Severin] Very soon they were flying close to the speed of sound, and subsequently supersonic flight was achieved. As a result it was no longer possible to bail out of an aircraft using past methods. Stress loads on the pilot when attempting to exit into the airstream at an airspeed of 500 km/h were so great that the effort exceeded his physical strength. He could be slammed by the airstream against the tail or fuselage. The catapult, known from ancient times, came to his aid. Theoretical and experimental work was performed at the Flight Testing Institute by a group of volunteer engineers, with the involvement of instrument and pyrotechnic design bureaus and the Parachute Institute, as well as prominent Soviet physiologists, specialists in the field of space medicine, and Air Force personnel, resulting in development of the first generation of ejection seats in this country.

[Dolgishhev] What determined your final choice?

[Severin] I was a senior engineer at the Flight Testing Institute when a number of pilot-ejection mishaps occurred during the war in Korea. Soon a survival systems research and development department was formed at our institute. It was headed by V. Utkin. I began working in what is now my beloved field in 1950, under his supervision. At first every design bureau which developed jet aircraft also developed its own ejection seat. The Mikoyan, Tupolev, Ilyushin, and Sukhoi people were all designing ejection seats.... Of course they were unable to develop a universal device which was reliable in all respects, because, after all, the aircraft was their main focus of attention.

Finally in 1952 a government-level decision was made to establish a single national center for development of survival systems, and in 1964 the order was signed appointing me chief designer and general manager of the Zvezda Plant. We soon submitted for government testing the K-36 standardized ejection seat, which could be installed in any aircraft. Tests showed the superiority of its design over ejection seats developed by various companies which were in use at the time.

Our firstborn did not have an easy time of it initially. Clash of views and opinions, rejected solutions and unexpected innovations—all these things occurred in the process of design, construction, testing, and refinement.

The main difficulties, however, still lay ahead of us, in the process of adoption. And this was in spite of the fact that using the K-36 in place of the various types of "local" ejection seats promised considerable financial savings, since many types of component systems and mechanisms could be removed from production.

Another important consideration was the fact that pilots would not have to retrain when transitioning from one aircraft to another. This also, figuratively speaking, reduced the degree of the unknown—the magnitude of technical risk, the boundary area separating assured ejection from disaster.

One must give due credit to Pavel Osipovich, who saw the promise of the standardized ejection seat. He was the first, installing the K-36 on his Su-24 tactical bomber, and it did a fine job. Incidentally, weapons officer Osmanov was the first to eject safely from the ground, from this aircraft. He was thrown to a height of about 70 meters, and his parachute was opened automatically. Other chief designers, however, took their time about adopting the K-36 in their aircraft; localistic pride held out for quite some time.

The death of Valentin Danilovich during government acceptance testing also was a factor. It never should have happened: due to pilot error Valentin was dropped not over the proving ground, where all the safety devices stood ready, but into the bay, onto water. He drowned, tangled in his suspension lines. Those who were in no hurry to abandon the old ejection seats hastened to exploit this incident....

I succeeded at the time in getting them to continue the testing—Oleg Khomutov ejected under the same conditions (at Mach 1.5). The ejection seat functioned perfectly. Soon thereafter Khomutov was awarded the title Hero of the Soviet Union for his contribution.

[Dolgishhev] How did events proceed from there?

[Severin] Yakovlev was developing an embarked VTOL aircraft. I suggested he use our ejection seat. It was capable of ensuring pilot survival during the most critical phases of takeoff and landing. This factor convinced naval aviation authorities, and they prescribed that it be used on the Yak-38 and Yak-36U. After the Yaks, our ejection seat was placed on other aircraft as well.

We addressed much more serious problems jointly with specialists from the Yakovlev Design Bureau, the Flight Testing Institute, and the Voskhod Experimental Design Bureau, in designing an automated ejection system for VTOL aircraft. The fact is that a carrier pilot simply does not have enough time correctly to assess an emergency situation and to make the decision to eject during takeoff and landing. This is confirmed, for example, by the fact that the British, who have the same type of aircraft, the Harrier, but which lacks an automatic ejection system, have experienced 100 percent fatalities from mishaps occurring under these conditions.

This means that the pilot must be assisted. And not only by improving the quality of the ejection mechanism; the ejection system must be forced to "think." for example, the roll attitude has gone beyond the allowable limit, and the automatic control device, which is programmed for all types of emergency situations, triggers the ejection system. We should also bear in mind that the ejection

seat is designed to save the crew in a combat situation. This means that we must consider the possibility that the pilot may be wounded, may lose consciousness during violent maneuvering, and that ejection may occur close to the ground or water surface when the aircraft is in an unfavorable attitude. The automatic ejection system should assume the entire burden of decision-making, determining the ejection trajectory, and selecting ejection height.

And such a system was developed, which saves a pilot without him being aware of it, automatically and at that moment when the situation on takeoff or landing becomes uncontrollable. It was the world's first such system. And, I believe, we have achieved unparalleled results: 100 percent of pilots who have "utilized" our ejection seats with an automatic ejection system have survived. No wonder pilots call them our "guardian angels."

[Dolgishhev] What are the overall statistics on the K-36? After all, it is currently in use on virtually all latest-generation Air Force aircraft.

[Severin] To date there have been more than 300 actual-emergency ejections during operational use, in the most diverse conditions and for various reasons. There have been ejections on the flight line, at the moment of liftoff, during landing, and in proximity to the ground with the aircraft in an unfavorable attitude. And almost all pilots have survived. 97 out of 100 ejections are accomplished with virtually no injury, while in the past the success rate was 82 percent. 3 percent of air mishaps involve failure of aircraft systems during an emergency situation. For example, the pitot-static head is damaged because the protective deflector—an inclined plate which moves forward on a telescoping rod when indicated airspeed exceeds 800 km/h and reduces dynamic pressure in the airstream—has failed to deploy. I could also cite a case of laxity of discipline, where a pilot failed to buckle his parachute harness. People are killed because they are too late in making a decision....

[Dolgishhev] What would you, as chief designer of life-support and survival systems, like to say to Air Force flight personnel, engineers and technicians?

[Severin] Our ejection system provides capability to save the life of a pilot, wearing special gear, at all aircraft operational altitudes (from takeoff roll and landing rollout to the aircraft's service ceiling), at indicated airspeeds from zero to 1,300-1,400 km/h. However, one must use the ejection system properly and in a timely manner; one must be familiar with its design, ejection airspeed and minimum safe altitude limitations which, even for systems designed for ejection while the aircraft is rolling on the ground, can be as much as several hundred meters (at high flight path angles and at particularly high rates of descent). A pilot, when attempting to save his aircraft, should know about this and should always remember these things.

The K-36 is a rather sophisticated device, which embodies many scientific and technological advances. And work is continuing on improving its reliability and broadening its capabilities.

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Mi-28 HAVOC ATTACK HELICOPTER DESCRIBED

90R90002L Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 2, Feb 90 (signed to press 4 Jan 90) pp 26-29, C4

[Article by AVIATSIYA I KOSMONAVTIKA correspondent Lt Col V. Bezborodov: "The Mi-28: Soldier-Helicopter"]

[Text] After being shown at the 38th annual Paris Air Show at Le Bourget, the Mi-28 combat helicopter suddenly found itself a celebrity, so to speak. Not only the visitors at the air show but also the participants, and particularly the veteran engineers and pilots of the U.S. companies McDonnell-Douglas and Sikorsky Aircraft, who had developed and tested the AH-64 Apache and Blackhawk helicopters, acknowledged the success of the Design Office imeni M. L. Mil. The Mi-28 was demonstrated to crowds of Soviet spectators at the air show at Tushino. This generated even greater interest in the aircraft. Our readers have been writing in and asking: "Tell us something about this amazing helicopter. Who designed it, and what are its capabilities?"

AVIATSIYA I KOSMONAVTIKA correspondent Lt Col V. Bezborodov got together with the people at the Design Office imeni M. L. Mil who, under the direction of Senior Chief Designer M. Tishchenko, took part in design and development of the Mi-28 helicopter. The countenance of this "product," its capabilities and conditions of operation, servicing and maintenance were gradually revealed in interviews with deputy chief designer M. Vaynberg, Mi-28 project supervisor, with deputy chief designer Ye. Yablonskiy, with Honored Test Pilot USSR G. Karapetyan, and with weapons officers [shturman-operator; also translated as weapons operator and as navigator-weapons operator] V. Bukharin and Yu. Chapayev. We also gained an appreciation of the difficulties encountered by the designers of this aircraft.

* * *

Conceptual Design and Countenance

Why was this new helicopter developed? After all, the Air Force already has in service the fine-performing Mi-8 and Mi-24 helicopters, which have been fully combat-proven, modernized and upgraded to meet today's requirements on military hardware. But the time is coming when further modernization and upgrading of current service models is becoming little-effective. In

addition, other countries are moving forward, incorporating advanced engineering concepts into new rotary-wing aircraft designs. We are not seeking military superiority, a declaration which has been repeated time and again by party and government leaders, but we must ensure parity for the sake of future generations, for falling behind in technology, and particularly in military hardware, is fraught with serious consequences.

The process of designing and developing new aircraft is a long and difficult one, requiring a considerable amount of work and patient engineering refinement. But what if the design engineers have failed correctly to determine the direction of technological advance and must go back to square one, losing months and even years in the process? This is why many organizations, both industrial organizations and the client, assembling the finest scientific minds, so thoroughly analyzed the experience of employment of the Mi-8, Mi-24, and foreign combat helicopters, and devised an optimal conceptual design for the Mi-28, following a cost-effectiveness criterion.

The engineering design is grounded on implementation of the unique ability of helicopters to hover, to travel and turn in any direction, and especially to fly at extremely low level, literally to a height of 5 meters above the treetops. "Airplane" speed is not as important as the capability to maneuver undetected by the enemy, utilizing natural and man-made cover. If a helicopter is equipped with a highly-trainable, high-resolution surveillance and targeting system [reference to undernose electro-optics pod] and carries potent, highly-accurate, long-range armament, it becomes a fundamentally new weapon.

A helicopter should not only be able to destroy the enemy but also to survive combat. Surface-to-air missiles become little-effective at very low altitudes, but a helicopter becomes much more vulnerable to small-arms and small-caliber artillery fire. How can unwarranted losses be avoided? How can one provide excellent performance characteristics and increase the effectiveness of aircraft employment in any environment? It is essential to do everything possible to accomplish crew survival and prompt extraction when a helicopter sustains battle damage. Operational and maintenance requirements are also important: air transportability, minimal labor and time requirements for mission preflight preparation and mission turnaround servicing [refueling/rearming], as well as aircraft self-sufficiency [capability to operate out of sites lacking ground servicing equipment]....

Let us "take a peak behind the curtain," to see to what extent they have succeeded in accommodating these frequently mutually-excluding requirements. The fact that in the final version the helicopter follows a traditional single-rotor design with a two-man crew is not a matter of tradition but rather the result of analysis of a great many variations and careful selection of the

optimal variation. Proposed designs included two independent, separated main rotors, plus many other configurations. There was also much debate over crew size.

Currently all combat helicopters in service throughout the world carry a two-man crew, and in the opinion of the Mi-28 designers there is a good reason for this. The experimental prototype of this helicopter took its maiden flight in December 1982, and sufficient operating experience has been gathered to reach some general conclusions. The aircraft's mission: to fly at a height of 5-15 meters above irregular terrain and at the same time to seek out targets located at considerable distances from the helicopter, utilizing magnifying optical devices—cannot presently be performed sufficiently effectively with a one-man crew, even if he is assisted by highly-sophisticated, state-of-the-art electronics. For in addition to the mission of engaging the enemy, the pilot must avoid attack by hostile air or ground assets. And all this while in nap-of-the-earth flight! If one becomes distracted for just a few seconds.... G. Karapetyan, V. Bukharin, Yu. Chapayev, V. Tsygankov, and V. Chernyy flew a great many test flights and reached the ultimate conclusion that a two-man crew is essential.

The pilot's job is to fly the helicopter and fire its unguided weapons, while the weapons officer's job is to seek out, detect, identify, and destroy small targets at maximum range using precision guided munitions and gunfire, as well as to navigate. According to the test crews, there is more than enough work for two crew-members. The designers therefore have done everything possible to assist the crew. Ergonomic requirements are much better met on the Mi-28 than on its predecessors. Systems control is maximally integrated, and controls are arranged so that flight controls are placed on the left panel, on the collective-pitch stick, and on the cyclic stick, while controls needed only in readying for flight are placed on the right-hand panels. Secondary quantitative information on systems operation is virtually eliminated; only that which is needed in combat is communicated to the crew. Cockpit visibility is excellent. The Mi-28 features improved piloting precision and weapons aiming accuracy, and weapons utilization sequencing priorities are provided.

The weapons officer's principal instrument is a highly-trainable surveillance and targeting system mounted on a gyrostabilized platform, which greatly increases electro-optics pod target search capabilities. In the daylight version the system contains two optical channels, with a wide and a narrow field of view, plus a narrow-field optical-TV channel. They are used not only in target search but also in target identification and weapons delivery.

The surveillance and targeting package is integrated and provides antitank missile guidance capability as well as fire control for the 30 mm gun. The gun has the same degree of travel as the sight and follows the latter in the synchronized mode. A laser rangefinder is built into the electro-optics pod package, determining current range to

target and feeding this information into the computers of the sighting system electronics package for computing corrections in automatic mode both when firing the gun and rockets. This same rangefinder provides data essential for launching guided missiles and selecting optimal missile flight path at moment of launch. The system also applies a signal to missile controls during guidance to the target. The missile travels at a high average speed and has a high propulsion energy figure.

Within visual range, when magnifying optics are not used, firing is performed using a head-up or helmet gunsight display, which controls the aimable gun.

Survivability

A great deal of effort was also invested to increase the helicopter's combat survivability. Survivability was engineered into the design right from the outset; this was given as much attention as aerodynamic efficiency and structural strength. But armor means added weight. Would this craft not become a clumsy brontosaurus, incapable of agile maneuver, and therefore become even more vulnerable? It turns out that a helicopter's best protection is not armor but rather the designer's ingenuity.

The physical layout of the helicopter provides mutual shielding of equipment and protection of more important items by less important ones. For example, the designers were able to place the engines in such a manner that the main reduction gearing lies between them. Structural materials and dimensions of structural members were selected so as to ensure against damage-caused catastrophic failure over a period of time sufficient to accomplish the mission and return to base. The main and tail rotor blades, for example, are fashioned entirely of composite materials possessing high residual strength when sustaining damage. Fuselage stringer dimensions and cross sections were selected in such a manner that when projectiles of the most probable caliber strike a structural element, they will not cause excessive loss of structural strength. The principle of making the most vital systems redundant has been widely applied. Control system wiring was also made redundant and spaced as widely as possible.

Armoring was used whenever other methods of protection proved inadequate or ineffective. The cockpit is fully armor-protected. Since this resulted in a considerable weight increase, a great deal of attention was devoted to reducing the cockpit surface area while providing the necessary cockpit visibility. Incidentally, as it turns out, these two requirements are not in conflict with one another. The lightweight armor with external ceramic tiles and the bullet-resistant cockpit glazing required designing a cockpit surface consisting of plane surfaces. Such a cockpit design simplified manufacture and also made it possible to incorporate cockpit glazing ensuring low probability of flashing or glinting from sun reflection. The designers also succeeded in simplifying repair of structural components, including those which

directly affect combat survivability. In particular, damaged armoring ceramic tiles can be replaced, and the aircraft features a latex self-sealing fuel tank liner.

Flight Performance

Providing combat survivability has in fact resulted in considerable added weight. How well have the designers succeeded in providing excellent handling and flying performance characteristics?

Studies involving the possibility of employment of combat helicopters in various theaters indicated that a helicopter can be used practically without limitations if under normal conditions it has a hovering ceiling of 3.5-4.0 km out of ground effect. The designers sought to achieve this performance capability, in spite of unavoidable difficulties. Upon completing engineering studies, the main rotor diameter was made the same as that of the Mi-24 helicopter, since "backward compatibility"—the capability to retrofit the more sophisticated Mi-28 rotor—would make it possible to improve the performance of the rotary-wing veteran. Using the regular-production Izotov TVZ-117 engines, with upgraded electronic control system, has proven to be a good choice.

Thus rotor efficiency and weight of the helicopter and its equipment proved to be practically the only parameters which could be engineer-influenced. A most difficult task arose: how was it possible, with substantially tougher requirements, to come up with a design which would weigh approximately 1 ton less than the Mi-24.

This problem was solved chiefly by choosing a strategy of significantly greater technical risk than in previous design projects. Fundamentally new designs were developed for the Mi-28 main and tail rotor blades and hubs, cyclic pitch control system, and main reduction gearing, plus a number of other components and systems. Composite materials are extensively employed in the airframe. The final engineering refinement phase naturally was longer, but the main goal was achieved as a result: takeoff weight does not exceed 10.4 tons, which guarantees a hovering ceiling of 3.6 km out of ground effect. The helicopter's service ceiling is not less than 5.8 km. The designers also succeeded in optimizing other performance characteristics.

Considerable attention was devoted to low-altitude handling and performance, ensuring a high degree of agility with maximum flight safety, which in the end provided capability to perform combat missions while providing the crew with a comparatively high degree of safety.

Crew Crash Survival System

It would seem that everything has been provided for, but combat is combat, and helicopters may sustain battle damage. Crew survival should be assured, however, even when sustaining damage. This also proved to be a difficult problem.

At extremely low altitudes it is impossible to parachute from a helicopter of this type, and therefore essentially

two possibilities "were competing" with each other in the selection process: ejection, or a system which would enable the crew to remain aboard the helicopter and survive a crash landing at G loads and speeds considerably above normal. Analysis indicated that an ejection method contains more weak points.

The crew crash survival system incorporates more highly shock-absorbing landing gear and crew seats, as well as a system for pulling crewmembers against their seats in order to establish the required "precrash position." Cockpit design ensures that crewmembers do not strike controls or objects in the cockpit interior, and that aircraft systems and components do not penetrate the cockpit during a crash. Sensors and other devices switch on the crash survival system automatically if the crew for any reason fails to switch it on manually, such as when the pilot is injured or when the decision is made too late.

The designers have succeeded, and this is a matter of some significance, in reducing the probability of fire and explosion immediately following a crash landing. As a result the crew crash survival system enables crewmembers to survive when the helicopter impacts the ground at a vertical speed of up to 12 m/s and at very high speeds with lateral and forward impacts. Parachutes are also provided just in case.

Aware of how important it is quickly to extract the crew of a crashed helicopter, the designers have provided the Mi-28 with a space which can accommodate two persons, although spartan accommodations at best.

Basic Specifications of Mi-28 Helicopter in Comparison With Its Counterparts

Specifications	Mi-28	Mi-24	AH-64 (U.S.)
Takeoff weight, kg			
normal	10,400	11,200	6,670
maximum	11,200	11,500	8,000
Maximum combat payload, kg	3,640*	2,700*	1,500
Hovering ceiling, m	3,600	2,000	3,100
Range, km	475	450	370
Maximum speed, km/h	300	320	300
Maximum load factor, g's	-0.53.0	1.75	3.5
Crew	2	2	2
Gun caliber, mm	30	12.7	30
Gun degree of travel, degrees			
in traverse	+/-110	+/-60	+/-110
in elevation/depression	+10	+/-20	+10
	-40		-60
Number of guided missiles	16	8	16
* including sighting systems and armament			

Ease of Maintenance

Unfortunately it frequently occurs that, in focusing on the sky, designers forget about the ground, as a result of which combat vehicle servicing and maintenance becomes much more complicated, and in extreme or emergency conditions becomes a most difficult task to accomplish. The designers of the Mi-28, and this is immediately apparent upon examining the helicopter, endeavored not to forget about this. And I believe that they have succeeded in taking a step forward also in providing for servicing and maintenance requirements. One's attention is drawn to a substantial decrease in the number of mechanical hinged or articulated joints, lubrication points, and threaded connections with torquing specifications, which require periodic checking and retorquing.

Many hinged or articulated joints have been replaced with fabric and elastomer bearings. Elastomer bearings are used in the main rotor hub, for example, replacing the traditional hub "sleeves" with mechanical articulated joints. As a result this hub has no lubrication points whatsoever. The tail rotor, comprised of two "modules" connected by a common elastomer bearing, contains only two lubrication points, while there are 12 lubrication points in the counterpart Mi-24 assembly.

Improved accessibility for inspection and servicing has been achieved by almost totally eliminating the use of stepladders, capability of fast, full opening of engine cowlings and equipment bay inspection covers, and checking of oil and hydraulic fluid levels through gauge glasses from the ground.

System status monitoring capabilities have been greatly increased. Built-in devices provide automated monitoring during preliminary operational procedures—preflight procedures, aircraft turnaround, and post-flight procedures—as well as onboard equipment malfunction check. Ground test equipment is required primarily for periodic inspection and provides for automated, considerably more detailed inspection.

The fact that specific aggregate servicing and maintenance labor requirements have been reduced by a factor of three in comparison with the Mi-24 helicopter, and by a factor of from three to nine for certain components and systems, indicates that they have succeeded in achieving improvement in servicing and maintenance.

If there arises the need to accomplish rapid redeployment of helicopters, they can be airlifted to the destination aboard An-22 and Il-76 transport aircraft with minimal disassembly, limited to removing the main rotor blades and stubwings. This was demonstrated in a practical manner at Le Bourget, when the helicopter was quickly reassembled after arrival aboard an An-22 and immediately made a practice flight.

Systems and components readiness can be maintained without firing up the engines and without unwarranted running of the rotor systems. The helicopter's electric

power, hydraulic and gas-pressurized systems can be run off an auxiliary power unit, which means that they can be maintained in good working condition without firing up the engines. Periodic inspection and maintenance are performed at intervals sufficient to enable helicopters to be operated away from base for a fairly long period of time.

Of course only regular operational service can fully reveal all of this helicopter's qualities, but it would seem that our scientists and designers, engineers and workers have succeeded in developing a well-behaved, agile, easy-to-maintain, formidable combat aircraft. It is the general view that the Mi-28 represents a new stage in the evolution of Soviet and world rotary-wing aircraft engineering. Incidentally, a glance at history shows that this design office has perhaps not been involved in a single design project which did not involve a technological step forward. The Mi-28 will take a worthy place in the ranks of combat helicopters.

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Psychological Compatibility Among Group Members Discussed

90R90002M Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 2, Feb 90 (signed to press 4 Jan 90) pp 32-33

[Article, published under the heading "For a High Degree of Combat Readiness," by Lt Col Med Serv A. Medenkov, candidate of psychological sciences, and Col Med Serv N. Tretyakov, candidate of medical sciences: "Are Psychologically 'Incompatibles' Compatible?"]

[Text] Knowledge in the field of psychology is slowly, extremely slowly, being used in restructuring economic and sociopolitical affairs in this country. The process of activating the human factor on the basis of psychology is also being unwarrantedly delayed in military units. Why is this happening, and what follows from this?

The psychological patterns and mechanisms of forming the individual, in regulating behavior and interpersonal relations also affect the joint activities of the various categories of Air Force specialist personnel. And effective interaction of aircraft crews, command post teams, air traffic controllers and alert-duty personnel in daily operational training activities is an effective means of achieving a new and qualitatively higher level in accomplishing the tasks of increasing the operational readiness of subunits and units and improving flight safety. And it is very important that this requires not additional material outlays on upgrading equipment and developing specialized training equipment and facilities, but requires only that one take into consideration the psychology of the individual. This means that it is up to commanders, supervisors, and political workers, who must be familiar with the principles of human intercourse and must utilize them in a skillful manner.

Just what is psychological compatibility, and are there in fact incompatible people?

This term is invested with various content. In one case incompatibility is considered in a broad frame and encompasses all psychological aspects of interpersonal relations: social, informational, economic, intellectual, moral, etc; in another instance it is defined as a description of the character and personality interrelations among the members of a group formed according to a formal, often production criterion. This applies primarily to the emotional aspect.

People with such traits as sociability, attentiveness, a tendency toward compassion, and self-criticism, for example, are psychologically compatible. Excellent results in joint activities are noted wherever the personality characteristics of group members mutually augment one another or possess similarity. Better quality of work performed is objectively recorded and there is a smaller number of faulty and nonoptimal actions among crews and operations shifts made up according to this principle. With random forming, for example, of air traffic control personnel duty shifts, in almost one fourth of cases psychological compatibility of group members is not achieved. This affects the morale and psychological climate in these groups and appreciably diminishes the effectiveness of their work performance.

Psychologically compatible individuals on a crew or work shift can be determined by elucidating their mutual likes and dislikes using so-called sociometric methods (see AVIATSIYA I KOSMONAVTIKA, No 11, 1981), as well as individual characteristics. The character of mutual relations, however, should not be elucidated directly. There exist many indirect indicators which make it possible not only to evaluate but also to rank by degree people's desire to work together.

A favorable moral-psychological climate is formed if the head of a group and his deputy like one another and the others express willingness to work together, even in a unilateral manner. Possible thereby is the presence of a specialist who does not enjoy respect on the part of many individuals but who himself shows clear preference for these individuals.

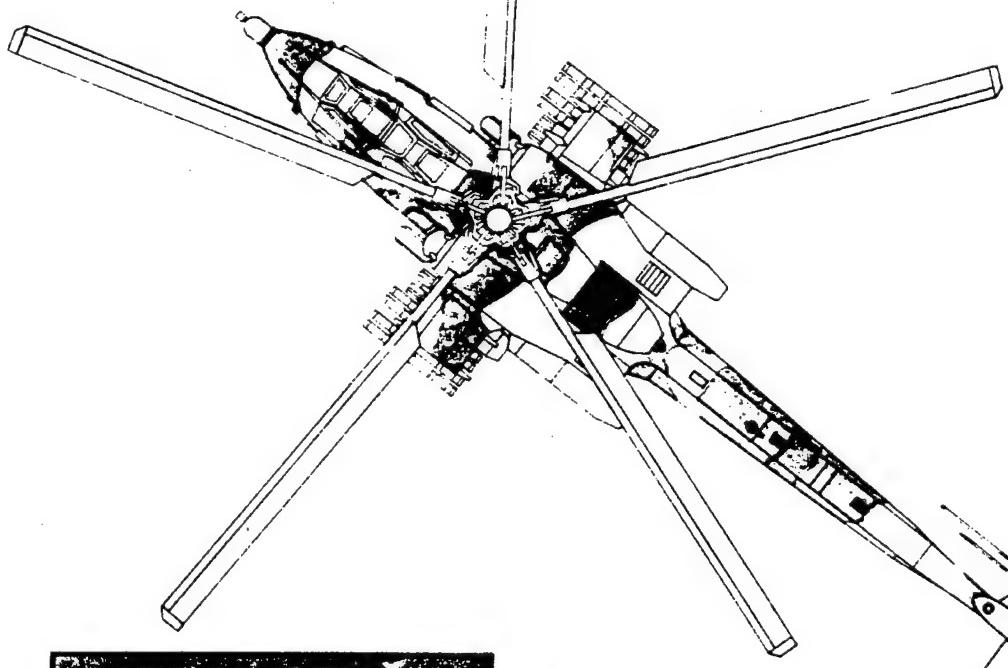
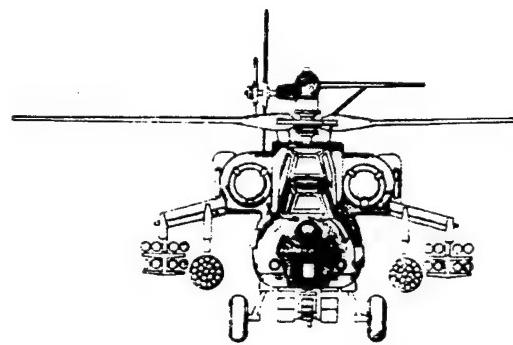
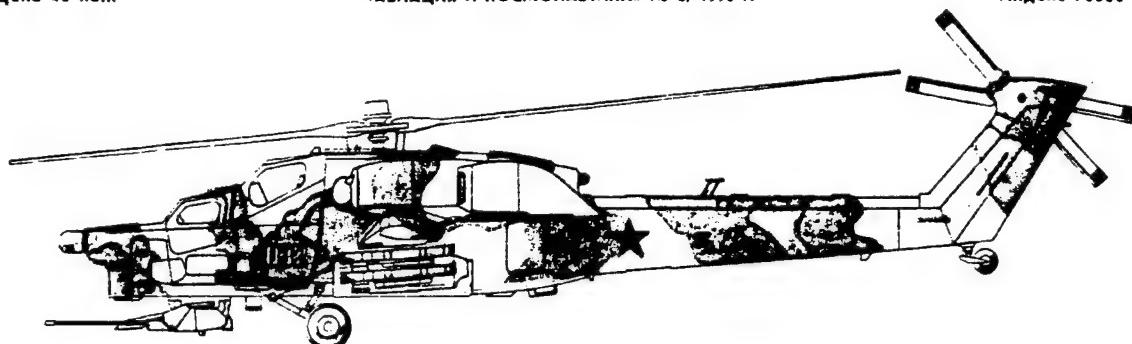
An adverse moral-psychological atmosphere can be anticipated in groups made up of persons who lack mutual liking for one another or for their superior. This is observed particularly frequently in groups made up of excessively sociable or sensitive individuals, as well as reserved individuals, with elements of alienation in interpersonal relations.

Sociometric methods are effective when the members of the body from which crews, teams, and duty shifts are formed have worked together and know one another well. Otherwise psychological compatibility can be predicted from the results of comparing individual personality traits. Analysis is based on efficiency reports, results

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of observations, interview results, and results of specialized testing. By what recommendations should one be guided?

Greater compatibility is observed in groups where the heads of the groups possess clear qualities of leaders, take an active experiential posture, and where sociable and energetic personalities predominate among their subordinates. It is a fairly complicated task to make up crews, teams, and duty shifts of those individuals characterized by clearly-marked properties and states: an uncommunicative nature, tendency toward depression, emotional instability, impulsiveness, nervousness, etc. They are rarely compatible with one another. At the same time, when surrounded by communicative individuals distinguished by straightforwardness in intercommunication, genuineness, and the ability readily to understand others, they do not display tension.

Can psychological compatibility be influenced?

It is a known fact that mutual informing by group members of their actions, open and free discussion of these actions, which eliminates ambiguity in cases of nonobvious goals, can prevent a distorted interpretation of actions by persons with a tendency toward nervousness and inner emotional turmoil.

A most important factor in achieving group cohesiveness is the acceptance of common goals and tasks by each group member. And we are talking about acceptance, not a lip-service action. For this reason goal-directed individual indoctrinational effort is essential, aimed at forming relations whereby common interests become individually important. And this applies not only and not so much to gaining material benefit as to social satisfaction with one's place and role. Group cohesiveness increases when the result of joint activity becomes more dependent on the success of interaction and cooperation by the individual group members.

But what fosters the effect of psychological incompatibility? We should attach primary importance to differences in dominant social attitudes, motives, and goals pursued in joint activity. One should not simultaneously praise the pilot for a skilled landing and reproach the navigator for errors in calculations, if the flight is graded overall as not totally successful. In this case crew members subconsciously form negative reactions which do not promote cohesion. It is even worse when to this is added awareness of the fact that somebody's needs are not being met due to passive or active actions by a specific individual.

The effect of dislike for one another is sometimes fostered by concurrence of personality and emotional traits. The presence of a high degree of anxiety in two interacting individuals can lead to its intensification and the occurrence of psychological incompatibility. Lack of understanding by subordinates of the motives for the behavior of their superiors is frequently a cause of conflicts. For example, a knowledgeable officer who was thoroughly familiar with the specifics of the job was

made shift supervisor at an air traffic control center. A demanding individual of integrity, who liked order in all things, at first he encountered a distrustful and hostile attitude on the part of his subordinates. And then suddenly everything changed! What had happened?

The center chief had placed him in charge of preparations for a sports holiday. And it turned out that off the job he was a sociable individual, capable of inspiring others, of displaying imagination, and of avoiding excessive regimentation. It then became clear to everybody that his strictness on the job was a result of a strong sense of responsibility for his assigned work area.

One should not assume that all conflicts within groups possess psychological roots. Deficiencies of education or upbringing, a poor level of knowledgeability and awareness, and individual psychological traits, in their extreme manifestations, frequently evoke hostility within a group. Ignoring colleagues, belief in the exclusive importance of one's own opinion, and display of lack of respect toward others frequently lead to failure to accept entirely reasonable, well-substantiated suggestions and recommendations, advice and requests.

Something similar occurs when a leader, by constant rebukes and inspections, creates such a negative attitude toward himself that even his sensible advice is perceived negatively. For this reason it is important precisely to determine the degree of influence of social, psychological, and personality factors and deficiencies in upbringing on worsening of mutual relations between colleagues. Only then will there not be attempts to attribute an unfavorable atmosphere to psychological incompatibility. Accuracy of diagnosis determines the success of joint actions on the part of commanders, political workers, and psychologists to unite and mobilize collectives.

Demands for greater closeness between superiors and subordinates and for activation of the human factor are incompatible with ignoring the needs and aspirations of subordinates and with a slighting attitude toward the psychological principles of organization of joint activity. Today a great deal, and sometimes the overall end result, depends on successful interaction within the crew, team, and duty shift.

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Political Conference Stresses Indoctrination of AF Alert-Duty Personnel

*90R90002N Moscow AVIATSIYA I KOSMONAVTIKA
in Russian No 2, Feb 90 (signed to press 4 Jan 90) p 35*

[Article, published under the heading "In the Air Force Political Directorate": "Party Attention to Alert Duty"]

[Text] Another periodic meeting with party committee secretaries was held in the Air Force Political Directorate. On this occasion secretaries of party committees of air units performing alert duty were invited to attend.

Participants in the get-together noted that the work load on alert-duty forces remains high and that the number of airspace intrusions is not diminishing. Lt Col I. Ryzhenkov, for example, stressed that intensive activity on the part of alert-duty forces is testimony to continuing tension in the world. We are being tested for alertness and probed to detect weaknesses. In these conditions as well a focus toward continuous alertness, a high quality of unit and subunit combat training, and continuous unit and subunit combat readiness should remain the core of party political work.

Proceeding from the present social and ideological situation in this country, a conclusion was reached: today it is more essential than ever before to rebuff any and all pacifist fabrications from a position of overall party demands, and to indoctrinate the personnel of Air Force units in a spirit of a realistic understanding of the military-political situation in the world, and properly and adequately to form and shape public opinion in military units pertaining to matters of war and peace.

The majority of political agencies and party organizations have derived genuine lessons from deficiencies which have occurred in the past in accomplishing the missions of alert duty. Party committees have taken additional measures to strengthen their influence on increasing combat readiness, vigilance, and on strengthening military discipline. One can observe a certain amount of positive experience in this.

For more than three years now, for example, the men of the air unit in which Maj V. Kutepov is a party committee member have been performing alert duty within the air defense system. Party influence on the quality of performance of alert duty is fairly effective in this unit. A working group to solve problems which arise has been formed under the auspices of the party committee, and they are following the practice of distribution of assignments to party members going on alert duty. It has become a practice at party meetings, when the secretary reports on work accomplished, to analyze the party's influence and the vanguard role of party members on performance of alert duty. Political evaluation of alert-duty forces personnel, which has twice been performed in the unit, has helped eliminate officers with poor moral-political and professional qualities from tactical command and control agencies.

The party committee on which Lt Col V. Pavlenko serves as secretary is waging a vigorous, uncompromising campaign for purity in the ranks of alert-duty forces. He maintains the attention focus on the political, moral, and job-related qualities of flight personnel, engineer-technician personnel, and compulsory-service personnel. Party committee members visit the alert-duty flight on a daily basis and analyze the morale and psychological state of flight personnel, the state of readiness of the aircraft, living conditions and services, meals, and take party measures to correct deficiencies.

Daily living conditions for personnel in alert-duty forces is a party concern. This is the view held in the party organization of the unit with which Maj N. Kalashnikov serves. With the active support of the party committee they have established a psychological relaxation room and have repaired and refurbished facilities for alert-duty forces. Party committee members have been at the forefront in all these undertakings and practical activities. And the men, seeing this concern for their well-being, have adopted a stricter and more serious attitude pertaining to performance of their duties when on alert status. This approach convinces the men that one should not hope for help from the outside, that they themselves must do the job.

This same party committee has taken initial steps to establish contacts and ties with the party organizations of the air defense units in coordination with which they are performing alert duty. Air defense representatives visited the air unit, met with flight personnel, and briefed them on the specific features of joint operations. The Air Force men also visited their colleagues. The practical benefit from such contacts is obvious.

Also meriting attention are the activities of the political section in which Maj A. Podchasov serves as deputy chief. In their activities pertaining to mobilizing alert-duty forces they take into consideration the combat operations experience acquired by the unit's personnel in the Republic of Afghanistan. The political section publicizes fighting traditions and links vigilance and readiness on the part of alert-duty forces to analogous situations during the conduct of combat operations in Afghanistan.

At this meeting a great deal of attention was focused on alert-duty discipline. Participants expressed the opinion that serious deficiencies in performing this most important mission are possible wherever alert-duty discipline is not perceived as a phenomenon close to wartime discipline. The party committee secretaries unanimously acknowledged that it is high time for each and every party organization seriously to address the question of the vanguard role played by party members standing alert duty, to make a political assessment of their activities, and to hold each and every CPSU member strictly to account. The results of these efforts should be widely publicized.

Those who attended the meeting at the political directorate were unanimous in the view that the focal point of party efforts must be shifted to the alert-duty flight and to those personnel who are directly performing alert-duty missions. People must be clearly aware that assignment to alert-duty forces is an act of great faith and confidence and that their obligation is to perform their duties in a flawless manner. One must see this as the end objective of the entire indoctrination process and of party influence.

Soyuz TM Training Simulators Described

90R90002O Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 2, Feb 90 (signed to press 4 Jan 90) pp 36-37

[Interview, published under the heading "Cosmonaut Training," with Col V. Ulyanov, Cosmonaut Training Center staff specialist, by editors of AVIATSIYA I KOSMONAVTIKA: "Spacecraft Simulators"]

[Text] The beginning of manned space exploration signaled the birth of cosmonaut training simulator engineering, which dates back to the end of the 1950s and beginning of the 1960s. The *Vostok* capsule simulator, small training displays on which the operation of space capsule systems was demonstrated, and laboratories for practicing specific mission operations and procedures: this comprised the arsenal of equipment and facilities for training the first cosmonauts.

Over the years which have passed since that time, space hardware has gone through several stages of development and improvement. The *Voskhod*, *Soyuz*, and *Soyuz-T* spacecraft were developed and tested, and the *Salyut* orbital space station successfully completed its research activities phase. They have been replaced by the new, improved *Soyuz TM* transport spacecraft and the multi-purpose Mir modular orbital space station, plus a fundamentally new piece of space hardware which embodies the capabilities of both aircraft and spacecraft—the *Buran* orbital shuttle vehicle. All these stages have left their imprint on the countenance of the training equipment developed at the Cosmonaut Training Center imeni Yu. A. Gagarin.

The editors have asked Col V. Ulyanov, one of the Cosmonaut Training Center's leading specialists in this field, to tell our readers about some of the principal simulators and other training equipment used for training cosmonauts.

* * *

[AVIATSIYA I KOSMONAVTIKA] Vladimir Grigoryevich, February will mark the fourth anniversary of the launch of the Mir space station. Obviously the successful job performed by many crews which have visited the space station would have been inconceivable without prior training and preparation on the ground, and in particular on the Mir space station simulator. Could you describe it?

[Ulyanov] First of all I should note that this simulator is used to train cosmonauts on the Soviet and international manned mission programs involving the Mir - Kvant - Soyuz TM - Progress complex. It consists of two full-scale joined-together mockups of the Mir space station and the Kvant astrophysical module. Of course they have maximally preserved the external appearance of the space station and module, and the composition, location, placement, and layout of equipment are analogous to the actual equipment. For example, the following basic specifications of the complex were adopted in

building the simulator: the Mir orbital space station is 14 meters in length, 4.1 meters in diameter, usable interior volume totals 100 cubic meters, and the overall length of the mockup, with crew transport and supply spacecraft, is 35 meters.

The Mir space station mockup consists of a transfer module, work module, service bay and an aft docking port, interconnected by airtight hatches. During training sessions the crew can freely move between station modules and bays, and can also transfer into the Kvant module mockup, and in the future also to other applied scientific modules docked to the Mir station.

Simulator onboard equipment is located for the most part behind removable panels along the station's exterior walls. Securement points, external appearance and cabling are identical to the real thing. This makes it possible for crews to train in servicing, mothballing and demothballing systems, and in performance of repair and preventive maintenance.

Simulator equipment is of various types: regular working equipment, simulation or practice equipment, non-working full-dimension, and full-dimension weight-downsized equipment. The latter is required by terrestrial conditions, when an item's weight could exceed a cosmonaut's capability to manipulate it. Power supply and propulsion systems, fuel tanks, communications antennas, sensors, and other equipment positioned on the station exterior surface are in the form of mockups and are used primarily for visual learning of location. During training sessions virtually all these systems are operation-simulated aboard the space station simulator, which enables crews to work on the logic of their operation under normal conditions as well as upon occurrence of abnormal situations, malfunctions, and emergencies.

An optical-mechanical simulator system, which simulates the space exterior visual environment practically in all observation devices contained on the station, helps bring the cosmonaut training process closer to actual conditions. Simulation of system flight dynamics, onboard systems operation logic, and exterior visual environment simulator control programming are handled by a computer system which contains high-output YeS-1045 computers.

The crew training process is controlled from the engineer's control and monitoring console. The console is equipped with a YeS-7905 graphics display station (three displays), data repeaters, station onboard digital computer system displays, communications gear and TV monitors. The graphics display station makes it possible quantitatively and qualitatively to increase the volume of information presented to the engineer-methodologist during a training session and to utilize graphic-analytical methods of predicting dynamic processes, as well as a number of other capabilities inherent in such systems.

The orbital complex simulator, designed and built according to these principles, handles the principal tasks

of cosmonaut training, particularly during dynamic operations (maneuvers, approach and initial docking contact, hard docking, undocking, orientation, and stabilization) using the onboard digital computer system; performance of manual orientation and stabilization utilizing onboard observation devices; processing of navigational measurements and solving navigation problems; control and monitoring of the fueling system controls when transferring fuel to the station from a resupply craft; medical monitoring, using onboard equipment, and performance of medical and biological experiments; conduct of communications with a Mission Control communicator; performance of an aggregate of scientific, technical, and astrophysical observations and experiments on the Kvant module simulator equipment; performance of filming and TV sessions; performance of installation-deinstallation and repair activities.

In addition to the integrated simulator, there are a number of specialized simulators at the Cosmonaut Training Center imeni Yu. A. Gagarin, on which crew members practice individual elements pertaining to space station control, working with continuously-operating systems, preparation of station systems for EVA, and EVA using the special self-contained means of cosmonaut locomotion.

[AVIATSIYA I KOSMONAVTIKA] Our readers would like to know how cosmonauts are trained for a Soyuz manned mission. I know that you have such a simulator, and I would imagine that this veteran has been fully perfected, both methodologically and technically.

[Ulyanov] The Soyuz manned spacecraft simulator is indeed constantly being improved, as is the spacecraft itself, incidentally. The simulator today includes full-size mockups of the descent module (SA) and the orbital module (BO) of the Soyuz TM spacecraft. The simulator does not include a spacecraft instrument module-service module, but the operation of all its systems is simulated with computer software.

The descent module simulator contains three crew seats: for the mission commander, for the flight engineer, and for a mission specialist. In front of them is an instrument panel, with an optical sighting device in the center. Images of the earth, the sun, the star-filled sky, and the orbital space station complex during approach and docking are simulated in this sighting device, aligned to the attitude of the spacecraft. An image of the space station complex can also be seen on a TV monitor located above the optical sighting device. There are also control and display arrays on the instrument panel for control commands and monitoring of their execution in the spacecraft's systems, and located under the instrument panel are the manual control valves for the gas supply system for the mockup interior and the spacesuits.

At the mission commander's station, just on the actual spacecraft, there are two controls for controlling displacement of center of mass and spacecraft rotation on

its center of mass. At the top of the descent module there is a transfer hatch providing access to the orbital module.

There is a dish storage cabinet and a couch in the orbital module. A control panel for controlling docking seal between the ferry craft and the orbital complex is mounted atop the cabinet. One of the view ports is used for external observation and for conducting experiments.

The star-filled sky simulator is a precision mechanical system with a number of drive systems and servo systems. There is a black sphere studded with small shiny balls of various diameter, simulating stars, inside the simulator. The sphere is three-axis gimbaled. An earth and sun simulator is positioned alongside the star-filled sky simulator.

An image of the earth on color film, at a scale corresponding to the base orbit altitude, is transmitted to the optical sighting device. The direction of the earth's rotational motion and orientation toward earth change as a cosmonaut manipulates the controls.

The sun is simulated in the form of a spot of light. This unit also contains two Mir-Kvant orbital complex simulators, used in practicing approach and docking. One is used to simulate an optical image of the space complex, while the other is used to simulate a TV image on the video monitor screen.

The principal work station of the engineer-methods specialist during cosmonaut training sessions is at the instructor's console, from which all training simulator systems are controlled, crew actions are monitored, initial conditions are set, emergency and abnormal situations are dialed in during training sessions, and a number of technical operations are performed, testing the functioning of individual training simulator systems.

Instruments, displays, diagrams, and annunciator panels on the console provide capability to monitor spacecraft systems operation and accuracy of crew execution of specified instructions. The radio communications system simulates communications between spacecraft and Mission Control personnel. Console TV screens provide an image of the descent module and orbital module interiors (infrared TV) and the image observed by the crew on the optical sighting device and video monitor. Crews also practice conducting TV broadcast sessions from space.

The rooms adjacent to the training simulator contain digital computers which synchronize operation of simulators, systems, and instruments, and process display panel and control signals.

[AVIATSIYA I KOSMONAVTIKA] Vladimir Grigoryevich, you have mentioned the layout of the Soyuz TM spacecraft integrated training simulator. But where do they practice skills in dynamic operations, such as approach to and docking with the Mir space station?

[Ulyanov] We have a specialized trainer for these purposes. Soviet and international crews have logged about 1,500 training sessions on it to date, practicing manual control skills during the phases of approach, initial docking contact, docking abort and go-around, and hard docking with the Mir-Kvant orbital complex on both the day and night sides of the earth. Just as in real conditions, during training sessions the orbital complex may be stabilized in space or may have residual angular rates of rotation.

The trainer consists of a descent module mockup, external visual simulators, TV equipment, a digital computer system, monitoring and control panel, equipment coupling devices, and a spacecraft and service radio communications system.

The descent module mockup contains seats for the mission commander (in the center), flight engineer (left), and mission specialist (right). It is equipped with a cosmonaut panel, manual controls, communications and TV systems, and visual observation devices.

The mission commander performs manual control of approach, initial docking contact, and hard docking with the above-mentioned two controls. The mockup setup is slightly different for practicing crew responses to abnormal or emergency situations. A rangefinder and control stick are mounted by the mission specialist's view port.

Optical-mechanical orbital complex image simulators are located alongside the descent module mockup. One of the simulators is used to generate an optical colored image in the sighting device, a second simulator generates a TV image on the video monitor screen, while a third simulator generates an image of the earth in the descent module's observation devices.

Parameters pertaining to the relative motion of the ferry craft and the space station are specified and monitored in alphanumeric and graphic form in graphic display formats. Data on crew performance is documented in training session reports and in the form of docking approach trace charts.

The onboard and service radio communications system simulates operation of the regular spacecraft communications system and also provides communication among the specialist personnel manning the training simulator.

[AVIATSIYA I KOSMONAVTIKA] I would like to return to our first question. It is possible, as Academician V. Mishin suggests, to train cosmonauts without your trainers and simulators?

[Ulyanov] That is a very interesting question from the standpoint of position regarding development of training facilities and their significance for cosmonaut training. The fact is that certain ministries and other agencies have a fairly negative attitude toward this problem. While not denying the need for high-quality cosmonaut mission preparation and training, at the same time they

are not very concerned about further improvement and development of trainer and simulator facilities. In addition, under the guise of pluralism of opinions, suggestions are being made that we stop building some training simulators and even close down the Center, with cosmonaut training to be conducted aboard actual spacecraft being readied for launch.

Such a position does detriment not to the Cosmonaut Training Center. The Center occupies a firm position in our national space exploration program. Benefits of the moment do harm first and foremost to advance of the Soviet space program and to the country as a whole.

Negotiations have been held and contracts signed pertaining to commercial-basis flights for cosmonauts from Japan, Austria and Great Britain. A large part of the hard-currency payments will go into the government fund to finance our expenditures abroad to benefit the economy. And our nation as a whole will be judged by how we look in training cosmonaut candidates from other countries.

In conclusion I should like to note that the technical facilities established at the Cosmonaut Training Center are unique, and in certain aspects are head and shoulders above the world level in the area of trainer and simulator design and construction. We shall not yield our leadership position, for such a thing would be incomprehensible to those who will come after us.

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West European Nation Space Programs Reviewed

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[Article, published under the heading "Readers Request," by A. Kislyakov: "Space Program in the Countries of Western Europe"; concluding part of two-part article (Part One, see AVIATSIYA I KOSMONAVTIKA, No 1, 1990)]

[Text]

West Germany

In spite of the fact that this country has always devoted due attention to space research, until recently it did not have a unified center for coordinating efforts in space research. Finally in the summer of 1989 the National Space Research Agency (DARA) was officially inaugurated in Bonn. Professor Wolfgang Wild was named head of DARA. Seven persons were named to the organization's staff.

According to the official in charge of establishing DARA, T. Wedeking, by the beginning of 1990 the agency will have 60 employees, after which the staff will increase by 100 persons annually during the next two years. The agency's federal budget appropriation for 1989 was 35 million West German marks.

The establishment of a national space agency will unquestionably foster space program development in the FRG, but even at the present time a number of programs are successfully underway in West Germany, under the aegis of such industrial giants as MBB/ERNO, Dornier, and Siemens.

Perhaps the most significant project currently is the Saenger program, with MBB/ERNO developing the Saenger (named in honor of German rocketry pioneer Eugen Saenger) multiple-mission manned two-stage spacecraft. In the opinion of experts, this craft will be able to perform a broad range of missions, including relieving crews of future space stations, rendezvousing with space stations, and delivering various payloads into low earth orbit. We should discuss this craft's specifications and performance in somewhat greater detail, since it is of unique design and follows a unique mission profile.

The craft is to have a launch weight of about 400 tons. The first stage weighs about 300 tons. This winged, manned stage is powered by six hybrid turbojet-ramjet engines producing 35-40 tons thrust each. This stage is designed to carry a small number of passengers, who will be able to fly from Frankfurt to Sydney, for example, in less than an hour. A winged, manned Horus vehicle or an expendable unmanned Kargus supply-vehicle rocket can be used as second stage. Both stages are fitted with liquid-fuel rocket engines.

The Saenger craft is capable of taking off from any West European airfield with a 3,000-meter runway. After takeoff it heads southward, flying through the atmosphere at hypersonic speed; upon reaching the equator it turns eastward. Stage separation takes place at an altitude of 37 km. The first stage continues its cruising flight. The second-stage motors accelerate it to orbital velocity and inject it into an initial orbit of 80 x 450 km with the required orbital inclination.

To date a total of 195 million dollars has been allocated for carrying out the first phase of the Saenger program, which is to be completed in 1996. The craft's first orbital flight is scheduled for approximately the year 2006.

As regards civilian-application satellites, we should note that the FRG is virtually keeping pace with France in the development of a national satellite telecommunications system. Incidentally, the TV-SAT-1 satellite (this satellite is identical to the French TDF satellite, discussed in the first part of this article), boosted into orbit by an Ariane launch vehicle in November 1987, was unsuccessful. Its solar panels failed to deploy, as a consequence of which the satellite could not be operated. A TV-SAT-2 satellite is scheduled to be launched into orbit in February 1990. In June 1989 an Ariane booster successfully injected into stationary orbit a Siemens communications satellite, dubbed Copernicus. This satellite will provide radiotelephone communications, TV broadcasting transmission, as well as digital data transmission for West Germany and West Berlin. The satellite's launch weight

is 1,420 kg with orbital-insertion motor, the cylindrical satellite is 4.2 m in height, and the solar panels deploy to a span of 15.4 m. The satellite carries 11 repeater units operating in several bands. The satellite will cost 300 million West German marks.

West Germany's space program traditionally devotes particular attention to the development of space vehicles designed to conduct combined research.

We should note that West Germany is presently the only West European country which with its national space program has developed its own unmanned interplanetary probes, the Helios-1 and the Helios-2. These unmanned probes, designed to study the sun, were launched by U.S. boosters in December 1974 and January 1976 respectively.

The SPAS program has proven highly successful. This program has involved development and orbiting, using the space shuttle, of multiple-mission satellite-platforms designed to perform research and experiments using a replaceable payload. As of the end of 1989 two SPAS platforms had been placed into orbit—in June 1983 and in February 1984. Another shuttle mission carrying a SPAS satellite is scheduled for February 1990, but this time for the benefit of a U.S. Department of Defense program. The launch weight of a SPAS platform is 1,796 kg, and it is 4.2 m in length, with variable width, depending on the number of equipment-mounting sections. Duration of satellite autonomous flight in orbit is 48 hours. The remote mechanical arm is used to remove the satellite from the payload bay of the shuttle orbital stage and to retrieve it and return it to the payload bay.

I should like to say a few words about a future scientific satellite, the fate of which is also dependent on successful space shuttle flights. We are talking about the Rosat satellite, development of which has been completed by Dornier, under contract with the West German Ministry for Research and Technology. This satellite is designed to perform X-ray and ultraviolet astronomical research. The satellites launch weight is 2.5 tons, including a 1.4 ton X-ray telescope. It is anticipated that the telescope's sensitivity (diameter 0.84 m, focal length 2.4 m) will be five times that of the telescopes carried by earlier-launched satellites of the same tasking function. The launch of this satellite was postponed from 1987 to 1994 in connection with the Challenger disaster.

The FRG, just as France, is endeavoring to collaborate more closely with the United States in space exploration and research. In July 1989, for example, NASA signed an agreement with DARA which calls for expanded cooperation in the area of space research during the coming decade. In particular, the agreement calls for two West German astronauts to go up on the space shuttle in 1992 to service the Spacelab D-2 orbital laboratory. The agreement also spells out terms for conduct of joint experiments connected with the space station project.

West Germany has contributed the funds required for its participation in another shuttle mission scheduled for November 1993.

Great Britain

Activities in the area of space research and utilization of space in Britain are exercised by the British National Space Center (BNSS), which was established at the end of 1985. British appropriations for the space program totaled 120.9 million pounds sterling for the period 1987-1988. The bulk of space program activities, both national and within the framework of ESA, is being done by British Aerospace, Marconi, and Rolls-Royce.

We should commence our brief analysis of this country's space program with the HOTOL project, which on the one hand is the most intriguing and on the other hand the most debated and uncertain enterprise in the British space program.

The HOTOL (abbreviation for "Horizontal Takeoff or Landing") project involves development of a multiple-mission unmanned space transport vehicle. British Aerospace and Rolls-Royce have been engaged in development of this vehicle since the mid-1980s, virtually at their own initiative (that is, using their own funds). At first the idea of developing this craft was widely publicized, and it was particularly emphasized that Britain will possess its own space shuttle vehicle. The fact is that up to 1987 this program was supported by the British Government, which subsidized development costs through BNSS. Subsequently, however, the government's position regarding the project changed sharply, subsidies were terminated, and things reached a point where further independent existence of the program was placed in doubt. But top officials in the above companies think otherwise. Their confidence is grounded on the belief that other sources can be found for financing the project, for example, as a result of a cooperative venture with other British or foreign companies. A serious problem exists here as well, however. The problem is that the propulsion system being developed for the HOTOL craft is so highly classified that at the present time it is out of the question to consider possible extensive co-production. On the other hand, according to a report which appeared in the British newspaper THE INDEPENDENT at the beginning of 1989, in addition to British private-company sources of financing, Italian aerospace companies would be the most probable potential partners for British Aerospace and Rolls-Royce.

Continuing our discussion of the British civilian national space program, we must note that work is in progress only in the area of telecommunications satellites. Britain is the only West European country that has developed specialized satellites for military telecommunications, called Skynet. Launching of these satellites commenced in 1969. The most recent Skynet satellite, Skynet-48, a new-generation satellite, was boosted into orbit in December 1988 by an Ariane launch vehicle.

There is also another aspect to this country's activities in the space area—participation by British scientific laboratories in the U.S. SDI program. According to a report in the newspaper FINANCIAL TIMES, the (Kalemskaya) laboratory, near Oxford, is involved in projects being carried out by the U.S. company Grumman within the framework of SDI. This laboratory will be collaborating with Grumman on development of a demonstration-model particle-beam weapon for the U.S. Army. A 30-man development team is headed by a Dr Thomas Green.

Italy

Italy is currently in its fourth five-year plan (1987-1991) in the area of space research and utilization. In 1988 the government substantially increased appropriations, as a result of which approximately 800 billion lire will be allocated each year in the period 1988 through 1991 for Italian national programs and for participation in ESA programs.

Space program development will also be fostered by establishment in 1988 of the Italian Space Agency which, it is true, has already managed to become at odds with the government, a situation which in turn has had an immediate effect on financial support for the agency staff.

Aeritalia, Fiat, Selenia, and SNIA are doing the bulk of the work on space projects, both within the framework of ESA and on national programs.

These companies' efforts are concentrated on developing scientific and telecommunications satellites. San Marco series scientific satellites have also been developed and have been successfully in operation since 1964, designed to measure the density and temperature of the atmosphere, wind characteristics, electrical and magnetic fields. The last satellite of this family was launched into orbit in March 1988. The Lageos 2 geodetic satellite is currently under development; it is to replace the U.S. Lageos 1 satellite, which was launched into orbit in 1967. The Lageos 2 satellite consists of a metal sphere weighing 400 kg and 60 cm in diameter, carrying 426 prismatic laser reflectors.

The TS satellite project is extremely interesting. This project involves a satellite towed on a cable by the space shuttle orbiter. This satellite, designed to investigate the atmosphere, the ionosphere, as well as to conduct research in the area of geodynamics and plasma physics, would be released from the space shuttle orbiter on a cable of from 1.5 to 2.5 mm in diameter and up to 120 km in length. The satellite is designed to be reused (5-10 times). It could be launched as early as the beginning of the 1990s.

Work is nearing completion on development of an ItalSat preoperational telecommunications satellite, with launch scheduled for September 1990. It is supposed to provide radiotelephone communications on 11,000 channels in the 30/20 GHz bands. A decision was made

at the beginning of 1987 to develop an operational model, designated Italsat 2. Work is also in progress on the Sarit satellite, to provide Italy with direct TV broadcasting coverage, and the Sicral satellite, to provide government communications.

Sweden

Space research projects in Sweden are overseen by the Swedish Space Corporation, which is under the Ministry of Industry and Energy. Saab is the largest industrial firm working on Sweden's space program.

Sweden's greatest achievement is development (with U.S. participation, it is true), manufacture and launch in 1986 of the Viking satellite, designed to perform ultra-violet-band investigation of the magnetosphere and the aurora borealis. This satellite, with a launch weight of 536 kg, operated in orbit for about a year.

Promising future developments include the Tele-X telecommunications satellite, which will conduct experiments in the area of direct TV broadcasting as well as high-speed data transmission and video data transmission to Sweden and Norway. Sweden also plans to build three Mailstar satellites for "electronic mail." These satellites will help provide exchange of messages between Sweden and those countries with which communication is difficult via conventional channels. Messages transmitted from earth will be stored in the satellite's onboard memory (2,500-page capacity) and be retransmitted to earth when the satellite passes over specified points. Communications with any point on earth can be established within a few hours. These satellites will be launched into low, 800-1,500 km, polar orbit.

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History of Soviet Manned Space Program

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[Article, published under the heading "History of the Soviet Space Program," by Col V. Gorkov: "Resident of Startown"; concluding part of two-part article (Part One, see AVIATSIYA I KOSMONAVTIKA, No 1, 1990)]

[Text] A visitor to Zvezdnyy [Zvezdnyy Gorodok—"Startown", name of Cosmonaut Training Center] cannot help but admire the beauty of the training center's architectural layout and marvel, particularly after Moscow, at the cleanliness and primeval stillness of the place and the measured pace of life here. One also marvels at the sophistication of the equipment used in cosmonaut training. And yet if you look at the history of the facility, at the initial stage there was no long-term aspect to the Cosmonaut Training Center's master plan.

Thirty years ago neither the first head of the Center, Yevgeniy Anatolyevich Karpov, nor the first head of construction, Vasiliy Nikolayevich Sedov, could imagine even in their dreams what it has become today. Their

task was more modest: to provide favorable conditions for training the first cosmonauts. We shall therefore begin our discussion with establishment of the "old", as it is generally called informally, technical facilities area.

The first buildings—a therapeutic rest facility, an administration building, a classroom building, and a training simulator building—went on the drawing board in the fall of 1960. It is true that the process of architectural layout meant nothing, since the foundations for these buildings had been "inherited" from a military unit which had not actually been built, and standard architectural designs had been selected. A hotel design was adopted, for example, for the therapeutic rest facility, plans for a school were adopted for the classroom building, while the training simulator building was built from plans for a locomotive depot shed. Service structures were built alongside the specialized facilities: a boiler house, a transformer substation, water distribution and sewage treatment facilities.

The construction timetable was tough, and within a year the therapeutic rest facility, classroom building, and a 200-number telephone exchange were completed. V. Portnov, the first head of the telephone exchange, also served as the first cosmonaut instructor in receiving and sending Morse code.

At the same time the first training devices were being built at the center for the "special contingent," as the cosmonauts were called at that time. Training devices included a Treadmill Facility (1960), an "Ontokinetic Drum" (1960), a "Rotor" three-stage rotating cab (1961), a "Rocking Platform" (1961), a "Shielded Room" (1962), a "Hot Room" (1962), and an Anechoic Chamber (1963). These facilities were operated by A. Komarov, V. Potemkin, I. Rubtsov, I. Soldatov, N. Kuzmichev, I. Tyavin, and other Center specialist personnel. In 1961 the cosmonauts began taking familiarization flights aboard a Tu-104L flying laboratory. Cols A. Starikov and K. Tayurskiy devised and tested on this aircraft a procedure for creating "weightlessness."

As for flight training, at first it was determined by that experience which the cosmonauts had acquired at flight school and in the line units with which they had been serving. It was believed that primarily parachute jumping and athletic training were essential for developing volitional qualities and skills in controlling one's body in unsupported space. The cosmonauts commenced regular flight training in 1963, at which time a special air squadron was formed, under the command of Hero of the Soviet Union Col V. Seregin.

Since athletic training was initially considered to be of paramount importance, Center officials considered the matter of ways to build an athletic field and a swimming pool. The fact is that at the time, in order to build a stadium-type athletic field it was necessary to obtain permission from the USSR Council of Ministers. There was a housing shortage in this country, and funds were being allocated on a priority basis for erecting housing.

Finally authorization was obtained, and an athletic stadium with a running track was built. Things were easier with the swimming pool: the fact of its dual purpose was helpful. In addition to swimming, it was to be used for cosmonauts to practice water-landing procedures, and there were no construction delays.

One of the main problems during the early years of the Center was accommodations for the cosmonauts and support personnel. People commuted to work from the town of Shchelkovo and other nearby localities. This was both inconvenient and costly: each time a vehicle had to be sent out. Officials began thinking about building a housing complex in conjunction with the Cosmonaut Training Center. Strange as it may seem, at the time this idea had more opponents than supporters. Decisive in this matter was a meeting between the head of the Center, Ye. Karpov, and the commander in chief of the Air Force, who gave his consent to construction of a housing complex.

They began drawing up the preliminary design. At that time there were no experimental designs, but Center officials did not like the standard designs. But what could they do? Things had to get moving; construction had to be started. They began with two of six planned reinforced concrete panel-type buildings. At the same time they were giving thought to the question of how they could avoid putting up the rest of the buildings. Ye. Cherkasov, the Center's deputy chief for logistics, accompanied by cosmonauts, visited Gosstroy, the Main Architectural Planning Administration, visited Moscow's chief architect, and ultimately got his way. This was the first victory achieved in the course of building Zvezdnyy. This victory made it possible to shift to standard, but brick-construction buildings. Two such buildings were constructed. Today the cosmonauts reside in these buildings.

At this time the Zvezdnyy construction plans somehow came across the desk of USSR Deputy Minister of Defense Col Gen A. Komarovskiy. He did not like the plans, and Aleksandr Nikolayevich suggested holding a competition among the architects of Moscow and Leningrad. The Muscovites submitted six versions, and the Leningraders submitted two. The process of considering the plans took place in the office of Col Gen A. Komarovskiy. Other persons present included Maj Gen Avn A. Kuznetsov, head of the Cosmonaut Training Center, his deputy Ye. Cherkasov, and Yu. Gagarin. An introductory report was followed by a discussion of the merits of the entries, during which the representatives from the Cosmonaut Training Center made comments. In conclusion Komarovskiy proposed that one of the Muscovite plans be adopted and modified according to presented suggestions. This was the second major victory for the Zvezdnyy people. It opened up the way for building the facility that exists today.

At that time the manned space program commenced its victorious march forward. The Center grew with it. It was developing expanded contacts with various organizations in the Soviet Union, but difficulties were also increasing. Now it was necessary not only to provide motor vehicle transportation to Center personnel but to visiting personnel as well. And although the Center's motor pool was steadily growing, there was no end in sight to the transportation problem. The solution was obvious: build a platform-type railway station. L. Karpov, however, Moscow Railroad Administration chief, pointing out that regulations prohibited building stations closer than 3 kilometers from one another, refused to consider the proposal. They had to appeal to higher authority, particularly since there was already precedent for this.

Ye. Cherkasov and G. Titov went to see deputy Minister N. Gundobin at the USSR Ministry of Railways. Nikolay Alekseyevich greeted them very cordially: "What problems have brought you to me?"

German Stepanovich related to him their transportation problems and their meeting with L. Karpov.

"Nikolay Alekseyevich, the harmony of station placement is not disrupted," argued G. Titov. "There are stations at kilometers 35, 37, 39, and 41; this arithmetic progression should be extended at least to 43."

The deputy minister laughed, and replied: "I shall help you."

A panel appointed by N. Gundobin recommended that a station be built at kilometer 43 on the Yaroslavl rail line. It was then necessary to determine its size and configuration, and who was to build it. The matter of design was quickly settled: they adopted the design of one of the Moscow subway stations and adapted it to local conditions.

But difficulties again arose with construction. The Cosmonaut Training Center received no support from Moscow Railroad management. P. Popovich suggested that they go to the chief of railway troops. Thus initial contact was made with the military railway engineers at the initiative of Pavel Romanovich, and six months later the station was ready for service. It was christened Tsiolkovskaya. Several years later there was renovation being done on the Moscow Railroad, and a second platform was added at Tsiolkovskaya Station.

Construction of the first buildings brought forth the matter of landscaping with trees and shrubs, initially the training facilities area, and subsequently the housing complex area. At first the Center people handled this matter themselves, but later they realized that they would not be able to accomplish the job. At the Moscow City Soviet it was suggested that they go and see Nadezhda Fedorovna Ankudinova, who was in charge of landscaping one of Moscow's rayons. This lady, who was getting along in years, willingly acceded to the cosmonauts' request and took over supervision of landscaping

of Center facilities. The cosmonauts, in response to the solicitous treatment, fairly frequently visited the workers, put in public speaking appearances, and took part in award ceremonies honoring outstanding workers.

The workers planted flower beds at the Center, with flowers blossoming from May through October, and planted shrubs and lawns. The Center was growing more attractive with each passing year. Soon the field of potatoes and the vegetable plots, which clearly did not add to Zvezdnyy's beauty, also disappeared. With the cooperation of the Monino Forestry Section, this acreage was seeded in birch and evergreens. Today it is forest. This area has become a rest and recreation site for the people of Zvezdnyy.

When the master plan for Zvezdnyy was being considered, the plan for each building was not examined in detail. This is understandable: such a need arises on the eve of specific construction development. This was also the case with the Cultural Center, which is now called Cosmonaut House. Its standard plan clearly failed to consider the Center's future development. They began looking for a replacement. At this time they happened to be working on plans for a new Cultural Center. These new plans were approved following brief discussion.

On 6 November 1967, on the eve of celebration of the 50th anniversary of the October Revolution, the Cosmonaut Training Center Museum was opened at the Cultural Center. Leaders of democratic youth organizations from 82 countries were the first visitors to the museum, and Yuriy Gagarin acted as their tour guide. One year later the Center was given its present name. It was renamed Zvezdnyy effective 28 October 1968, by decree of the Moscow Oblast Executive Committee.

...30 years have passed since the directive ordering organization of the Cosmonaut Training Center was issued. Over the course of these years it has been transformed from a national into an international training center. Today not only Soviet cosmonauts but also citizens of other countries have learned and are learning at this facility the science of space flight. They have at their disposal unique training and athletic facilities, centrifuges, scientific laboratories, medical offices, a planetarium, and classrooms. Training is supervised by experienced specialists. Persons who were present at the very beginning are also working today at the Cosmonaut Training Center. They include A. Nikolayev, A. Leonov, B. Volynov, D. Zaikin, F. Demchuk, M. Goleusov, V. Lis, V. Portnov, V. Kutilin, P. Kirillin, B. Uvarov, I. Tyavrin, V. Aladina, V. Gromova, Ye. Ryazanova, L. Rafikova, L. Yurasova, M. Vasiliyeva, T. Nesterenko, M. Pochuyeva, P. Novikova, and Ye. Krupskaya.

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Developments in Aviation Abroad

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[Text]

Tomcat 21 Multirole Aircraft

Grumman Aerospace is doing preliminary work on a new multirole version of its F-14, dubbed the Tomcat 21. This new aircraft to enter service with the U.S. Navy in the next century. The new design is being developed at the initiative of and financed by Grumman Aerospace as part of a product improvement effort.

When the F-14 was designed, the U.S. Navy defined its basic mission as attack aircraft escort and fleet defense, with a secondary role of tactical interdiction and close air support.

The company decided to utilize previously-incorporated F-14 design characteristics which enable it to fly strike missions, and at the same time returning to the idea of commonality of engine design and construction for U.S. Navy and Air Force fighters. General Electric F110-400 engines for the F-14A Plus, which is to be equipped with the new powerplant, as well as for the upgraded F-14D aircraft, were added to Air Force procurements in order to take advantage of their reduced cost by increasing the total number of units built. Navy engines have 75-80 percent commonality with the U.S. Air Force's F110. An improved-performance F110-429, however, which will produce an additional 1,360 kg of thrust at sea level, will not be ready for service before 1992, and Grumman intends to use this engine for the Tomcat 21.

The new aircraft's design will be somewhat different from that of its predecessor F-14s. The principal difference is the elimination of slats in the inboard section of the wing. But the wingroot strakes will be extended forward in order to provide approximately the same area and will be used to accommodate additional fuel (1,180 kg), which will boost the aircraft's total internal fuel capacity to 8,530 kg. These triangular surfaces generate lift forward of the aircraft's center of gravity and help compensate for negative pitching moment when the center of lift displaces aftward during maneuvering at supersonic speeds, which is not required when flying air-to-ground missions.

The company is also modifying the Tomcat's lift augmentation devices in order to boost its lift coefficient at landing-approach angles of attack. Wind-tunnel tests of flaps of various configuration indicate an 18.5 km/h decrease in the present landing approach speed of 237 km/h. This will enable an aircraft returning heavy from a combat sortie with unexpended costly ordnance to make a carrier-deck landing.

The Tomcat 21's equipment suite, based on the F-14's digital electronic gear, will provide expanded capability for strikes on ground targets. The Hughes APG-71 radar will be modified for operation in target designation mode at high resolution and synthetic aperture in adverse weather conditions, day or night. It is to carry a laser rangefinder and tracking system unit compatible with existing infrared target search tracking systems, TV camera, and radar. It will also feature a forward-looking IR sensor for attacking ground targets.

The long-range standoff weapons with which the Tomcat 21 will be armed as well as replacement of gravity bombs with missiles will require the development of new software.

Initially the service life of the F-14 aircraft was pegged at 6000 hours, which was later increased to 7200 hours. Grumman intends to boost it to 9000 hours which, with the present intensity of utilization of military aircraft, corresponds to approximately 30 years of operational service.

Western experts believe that if an order were placed today, the Tomcat 21 could be ready for delivery by 1996 and would remain in service up to the year 2026. It is viewed not as a replacement alternative to the naval version of the U.S. Air Force F-14A tactical fighter but rather as a logical development of existing and potential armament.

Engine for the EFA Fighter

Eurojet, an industrial consortium with participation by four countries, is responsible for design and development of the new 9080-kg thrust EJ.200 engine for the European EFA fighter. This will be one of three design verification engines (DVE). Testing is to be conducted at a special facility in Munich.

Eurojet was organized at the Farnborough Air Show, as a consortium containing the following companies: Fiat, MTV, Rolls-Royce, and (Sener). At that time Eurojet's managing director announced that DVE engines would be operating at the end of 1988.

Prior to initial engine tests, Rolls-Royce conducted certain verification tests on the high-pressure compressor and turbine at an experimental facility, while simulating high-altitude conditions.

After testing of the DVE engine is completed at MTV, Fiat and Rolls-Royce will bring two more engines into the program. According to announcements by Eurojet, this research will be used to "test the integration of the total engine technology in the entire engine system before proceeding with full-scale development."

Rolls-Royce, which has a 33 percent share in development of the EJ.200 engine, extensively utilized its XG-40 demonstration engine to obtain data on general performance characteristics. Additional technology demonstrators which are contributing to the program include an aircraft engine featuring a promising primary duct

(Acme) and a demonstration unit which operates at high temperatures. Rolls-Royce is responsible for development of the EJ.200 engine's combustion burner.

The EJ.200 will be characterized by utilization of a fully digital engine control system (Fadec), the principal components of which were thoroughly demonstrated in the most recent versions of the RB.199 engine on Tornado aircraft.

Initial engine requirements will be 2000 EJ.200s for the EFA aircraft. The value of the engine contract is estimated at approximately one third of the value of the contract for the aircraft, which totals 5 billion pounds sterling. Eurojet reports that this engine has a potential of a thrust increase of 15-20 percent.

Aerial Refueling

The Falklands conflict underscored the need for aerial refueling and led to the development of modifications giving midair refueling capability to the MR.2 Nimrod and C-130 Hercules. Tests on refueling from large aircraft, however, such as the Hercules, the VC-10, and the new British Royal Air Force 1-10011 Tristar strategic tanker aircraft, have revealed a number of important facts.

For example, characteristics of an aircraft being in-flight refueled behind a tanker aircraft worsen in proportion to the tanker aircraft's wing loading. The higher the wing loading, the greater the downwash and the greater the drag coefficient of the aircraft being fueled. It was determined that required thrust to maintain position during contact with the tanker aircraft can be calculated, and this dictates the maximum refueling altitude for a specific aircraft.

Less maneuverable transport aircraft are characterized by poor engine response. A trim change when approaching the refueling hose drogue basket can generate 14-18 kg of force on the controls, depending on position relative to downwash from the tanker aircraft's wing. Tanker aircraft wingtip vortices can cause yawing motion under the effect of the airstream on the vertical tail of the Hercules from one side or the other. The Nimrod aircraft is also susceptible to yawing under such conditions.

Photographs of a T-tail VC-10 taken during aerial refueling clearly showed the stabilizer positioned within the tanker aircraft's condensation trail. Aircraft and armament research institute experts believe that fatigue failure from high-frequency tail buffeting could be more significant than from low-frequency buffeting. The institute will be certifying a hose-and-drogue aerial refueling system for the E-3 AWACS aircraft, as well as other equipment to be used only by Great Britain.

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ERRATUM: Loading Aircraft Ordnance Without Ground Equipment

[In JPRS-UAC-90-004 of 15 June 1990, in the article "Loading Aircraft Ordnance Without Ground Equipment," which begins on page 19, Figure 1, on page 20, was obliterated. Here is Figure 1, Built-in Ordnance-loading System. Top View.]

